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Contractor Report ARQED-CR-03001

RADIOLOGICAL CHARACTERIZATION OF BUILDING 611B DEPLETED URANIUM FIRING RANGE CHARACTERIZATION

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14. ABSTRACT

Building 611B testing facility at the Armament Research, Development and Engineering Center (ARDEC), Picatinny, New Jersey was used for firing operations and ballistics testing of small scale depleted uranium (DU/U-238) and/or staballoy kinetic engery penetrators and storage from July 1979 to October 1984. Uranium-238 and its short-lived daughters are the only radionuclides of concern. Subsequent to the approval of the Guitierrez-APalmenberg, Inc. (GPI's) drafts of a Project work plan, health and safety plan, and quality assurance plan to ensure compliance with the Nuclear Regulatory Commission license conditions, all pertinent regulations and permits, the characterization survey ended after 24 days with the demobilization of GPI on 13 May 1997. This radiological characterization report provides the information needed to decommission and remediate the Building 611B testing facility, which has not been used for DU munitions testing since the end of 1984, so as to remove it from ARDEC's SUB-348 license and free release it from radiological control.

15. SUBJECT TERMS

Radiological characterization report Target room ^{238}U ^{234}TH ^{234}Pa Thorium
Building 611B Staballoy tesing range Depleted uranium (DU) firing range tunnel Protactinium
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ACKNOWLEDGMENTS

As a result of the effort by Gutierrez-Palmenberg, Inc. (GPI), Joseph Fabiano of the Armament Research, Development and Engineering Center (ARDEC), Picatinny, New Jersey and Mike Styvaert of the U.S. Army Field Support Command (FSC), formerly the Industrial Operations Command (IOC), Rock Island, Illinois, the "Building 611B Testing Facility" consisting of building 611B, its accessory structures, and associated grounds underwent a characterization study to determine the concentration and distribution of depleted uranium (DU) in accordance with the work description of contract DAAA90-95-G-0017. The intention is to eventually have the Testing Facility not only decommissioned and remediated, but also to have it removed from ARDEC's SUB-348 license and free release it from the Nuclear Regulatory Commission and radiological control.

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Appendices

CHARACTERIZATION SUMMARY

The Building 611B Testing Facility at the Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey site was used for firing operations, ballistics testing of small scale depleted uranium (DU/U-238), staballoy (metal alloy made from high-density DU with other non-radioactive metals) kinetic energy penetrators for armor-piercing munitions and storage of armor plate and project related supplies from July 1979 to October 1984.

Gutierrez-Palmenberg, Inc. (GPI) performed this characterization study under contract to the U.S. Army Fire Support Command (FSC) formerly the Industrial Operations Command (IOC). A Project Work Plan, Health and Safety Plan (HASP), and Quality Assurance Plan (QA) were prepared and approved to ensure compliance with ARDEC's Nuclear Regulatory Commission (NRC) license conditions and appropriate regulations.

Most of the identified radioactive materials removed from the testing facility prior to the characterization were identified, inventoried, double bagged, and temporarily stored, in a secure and posted Military Communication Trailer (app A), which was used as an outside storage shelter. This ensured an accurate evaluation of the items pending classification by a broker that would be designated to remove, re-classify, re-identify, and re-package all the radioactive items into approved Department of Transportation containers to await on-post transfer, license-to-license transfer, and/or ultimate off-post Department of Defense (DoD) authorized disposal.

Routine air sampling taken by GPI during the characterization study indicated no external exposure to personnel and no detectable releases of radioactive materials either beyond the affected area or to the environment.

Various activities and levels of fixed and/or removable (loose) radioactive surface contamination were identified in the following places at the testing facility and described under the sections/components portions of this report:

- Base of the stairs and dirt under the wooden steps leading into the foyer
- Foyer (app B)
- Instrumentation room (app C)
- Non-DU firing range (app D)
- Depleted uranium/staballoy munition testing range tunnel (app E)
- Depleted uranium target room (app F)
- Inside storage room (app G)
- Multi-stage high efficiency particulate air (HEPA) filtration/ventilation bank (app H)

- Underground storage tank [(UST) (not available prior to decommissioning)]
- Outside, open, storage, platform/deck [also known as the gazebo (app I)]
- Building 611B associated grounds (app J)

Extensive soil sampling was conducted on the grounds outside the building in areas where it was reasonable to expect that radioactive material may have migrated from the various components making up the testing facility as a result of the storage of radioactive material on the outside, open, storage platform; tracking contamination from an affected area; and/or release of airborne contaminates from the HEPA filtration/ventilation system because of the unanticipated fire(s), which occurred within it.

Recommendations for remediation of the testing facility are included in this report.

There were no injuries to personnel during the characterization study.

There were no spills of hazardous or radioactive material during the characterization study.

SCOPE OF WORK

ARDEC is located in Dover, New Jersey. As a part of its mission, the arsenal designs, constructs, and tests weapon systems for the United States Army. This project, contract DAAA90-95-G-0017, a DU radiological characterization study of the Building 611B testing facility was completed by GPI in May 1997.

SITE AND CHARACTERIZATION METHODS

Building 611B was originally constructed in 1929 for use as a test range for firing artillery rounds until approximately 1959 when the east-west firing range tunnel was added to the existing non-DU firing range along with other structures for the testing of DU (U-238), staballoy kinetic energy, armor piercing projectiles, and the storage of armor plate and other project related supplies. In its original configuration, the north-south non-DU firing range was stated to be 373 ft 9 in. long. The DU/staballoy munition firing range tunnel is 40 ft long and intersects with the original non-DU firing range at approximately its midpoint. The only areas, surfaces, and/or components of radiological concern at the testing facility are those contaminated with and/or made of DU. On-site personnel have indicated that only the east-west tunnel was used for DU munitions testing.

Depleted uranium is used in munitions by the United States armed forces to enhance the energy level of a projectile. The DU used at the Building 611B testing facility was limited to firing small scale DU and/or staballoy kinetic energy, armor piercing, penetrators. They were loaded into the gun barrel located in the non-DU firing range and fired through a rectangular hole in the circular steel, dividing, wall/door at an armor target set-up on a stand in the target room. The target room, located at the west end of the DU/staballoy munitions firing range tunnel, was ventilated during firing by a HEPA filtration/ventilation system that discharged after four stages of filtration.

Over the years there was migration of DU from various sections/components of the building 611B testing facility. Affected and non-affected interior and exterior surfaces were gridded. Data which was collected from systematic/random direct measurements and smears, ambient air samples, and soil samples were organized and evaluated to determine the concentration and distribution of the fixed and/or transferable (removable, loose) contamination at the testing facility.

Reason for Remediation

The building 611B testing facility is no longer used for the testing of either DU or non-DU munitions. The operator's log (app K) contains the chronological history of the testing conducted in building 611B. This characterization report will provide the information needed to remediate and decommission the testing facility, remove it from ARDEC's SUB-348 NRC license, and free it from radiological control.

Management Approach

Gutierrez-Palmenberg, Inc. certified unexploded ordnance (UXO) expert sub-contractor personnel from Scientech, Inc. swept the surfaces of the testing facility for UXO and marked the unexploded surficial ordnance, which were found on the grounds to the east and north of the building for disposition by the ARDEC Explosive Ordnance and Technology Division (app L) prior to any characterization by GPI.

In areas where surface contamination was above the limits specified in the NRC Regulatory Guide 1.86 [section 5 (app M)], GPI established controls as required by GPI's NRC license number 27-29103-01 and ARDEC and GPI's radiation work permit and procedures, respectively. Areas where the soil activity exceeded 35 pCi/g (picocuries per gram) above background, a level identified in the Federal Register, 23 October 1981, V: 46, N:205, p 52081 and the State of New Jersey Department of Environmental Protection as the soil remediation level for DU are identified in this report. It is a commonly accepted level of remediation for DU in soil and accepted by the NRC.

All GPI crew personnel wore dosimetry. Personnel received no reportable radiation dose during the characterization of the testing facility.

GPI employees completed the on-site project work with on-site direction provided by the Project Manager, Thomas J. O'Dou, CHP (app. N) and the contract/interface project engineer, Joseph A. Fabiano.

Site Description

The building 611B testing facility at ARDEC is located on a large hill, which slopes about 10 to 20% and is littered with spent munition shells to an entry road that is below the grade of the building 611B testing facility. The road pavement leads to an outside, open storage area platform and outdoor storage shelters to the north and east of the "T" shaped building.

Type and Location of the Facility

The DU testing facility, located on the side of a large hill, is a scaled down version of a full size weapons range. The east-west DU (U-238)/staballoy firing range tunnel was added to the existing non-DU firing range, along with other structures for the testing of DU (U-238) staballoy kinetic energy, armor piercing projectiles, and storage in approximately 1959. It was not activated until July 1979 at which time it continued through October 1984 after which it was no longer used for either DU or non-DU munitions testing. No records were available to deter-mine its use between 1959 and 1979, if indeed it was used. A characterization study to deter-mine the concentration and distribution of DU and U-238 at the testing facility began in April 1997 in accordance with the work description of contract DAAA90-95-G-0017 with the intention of eventually having the testing facility decommissioned and re-mediated so as to remove it from ARDEC's NRC SUB-348 license and free release it from the NRC and radiological control. The testing facility characterization was completed in May 1997.

Ownership

ARDEC (Picatinny Arsenal) is owned by the United States Army.

Building 611B Testing Facility

The building 611B testing facility of approximately 40,000 ft^2 is bounded by a fence, brook, and entry road. It contains building 611B, accessory structures, and associated grounds that provided containment for the firing, testing, and storage of munitions.

Building 611B

The building 611B testing facility includes the following sections/components:

- Porch – includes the cement base at the bottom of wooden steps, wooden side rails, and wooden double doors, with windowpanes leading onto a platform, which leads into a foyer

- Foyer – wood frame structure on a concrete foundation with double doors with windowpanes leading to the loading area, instrumentation room, and a single steel door leading into the non-DU firing range. The floor is covered with vinyl tile possibly containing asbestos. The roof/ceiling is wood and fiberboard. It is 4 ft x 8 ft with a height of approximately 8 ft.

- Instrumentation Room – wood frame structure on a concrete foundation approximately 8.5 ft x 14.5 ft and slopes from 7 to 9 ft in height. The floor is covered with vinyl tile. The walls are concrete block and plaster. The roof is wood and fiberboard. This room is furnished with a small, dedicated, hand sink, which discharged via a plastic drain pipe, the only plumbing in the building, to the underground storage tank (UST)/sump located on the exterior, in the ground, to the south of this room. The room was used as an office

space and operations center for monitoring the ballistic firing and testing of small scale kinetic DU/staballoy, kinetic energy, armor piercing projectiles in the DU firing range tunnel.

- Non-DU firing range – primarily concrete block and concrete with a north end wall and sloping concrete sidewalls that support a corrugated steel roof. The range is approximately 6 ft wide by 58 ft long, which includes a concrete ramp that slopes at the north, catch box end, approximately 3 ft above the normal floor level. The height of the concrete wall is 5 ft at the entrance and 11 ft above normal floor level at the five-sided, steel, bullet catch box, north end of this range. The floor is covered with vinyl tile. It is perpendicular to and intersects with the east/west DU firing range tunnel. It is separated from an uncovered accessory structure to its north by the catch box that is snuggled up against a concrete wall. Although a gas gun had been designed for use in firing DU projectiles, site personnel have stated that DU rounds were never fired in the non-DU firing range.

- Depleted uranium/staballoy range tunnel – made up of four of five sections of reinforced concrete pipes, 8 ft in diameter with a wall thickness of 8.5 in. and a thick flat poured concrete floor making up this east-west tunnel. The DU firing range tunnel and target room are contiguous and consist of five sections of pipe laid end to end to make a total length of 40 ft. They are connected to each other from east to west with patching mortar/concrete and adhesive mixture/rubber sealant. The approximately 4 ft wide flat floor is poured concrete, covered with vinyl tile as in the non-DU firing range, instrumentation room and foyer except for the underside of a large steel gun mount weighing approximately 2.2 tons and located on the south side of the midline of this range. The gun mount is held above the concrete floor by wooden blocks and extends through a circular steel wall/door interface into the target room. A gun barrel fastened to the stand was loaded with small scale DU/staballoy, armor piercing, penetrators, which were shot through a rectangular opening in the circular steel wall/door interface at a target in the target room. This one holed, circular steel wall/door, divides the DU firing range tunnel from the target room. The door portion opens to permit the operator to set up the target and can be closed when firing at the target. This range also has a series of x-ray pulsers for in-flight measurements.

- Depleted uranium target room – this western most section of the concrete pipe tunnel is the end or the last of five sections of concrete pipe. It is doubly reinforced and interfaces with the inside storage room on the west, and with the DU firing range tunnel on the east. It is separated from the inside storage room by a circular concrete wall with a central rectangular opening sandwiched between two steel plates. The steel plate on the inside storage room side has an adjustable window whereas the one on the target room side is a rectangular plate, which acts as a backstop for shrapnel and/or projectiles fired at the target. The circular steel wall/door on the east is approximately ¼-in. thick and divides the target room from the DU firing range tunnel. The steel frame of this section of the concrete pipe tunnel consists of 2-in. angle iron and support hardware attaching it to the concrete sidewalls, steel front and

back walls. At the top of this pipe is a caged lighting fixture, a trouble light connected to an outlet in the DU firing range tunnel and an unscreened open paracentric 6-in. ventilation duct extending down through a penetration into the room above the target positioned on the gun stand/table. It is connected to the HEPA ventilation system atop the roof/deck of the inside storage room. The portion of the gun mount extending into this section is used for holding the armor plate targets impacted by small scale, DU/staballoy, kinetic energy, armor piercing projectiles.

- Inside storage room – rectangular steel paneled/wooden structure located at the west end of the five 8-ft in diameter, 8.5-in. thick walled sections of reinforced concrete pipe making up the target room and DU firing range tunnel. It has a wood framed ceiling, cement floor, and metal roof/deck with a parapet used as a deck/platform for the HEPA filtration/ventilation bank connected by ducts to the target room. The walls of this room are constructed of ½-in. steel plate panels. It interfaces on the east with the target room by means of a thick reinforced circular concrete wall with a central rectangular opening sandwiched between two specially configured steel plates. The steel plate on the east side of the inside storage room on the backside of the circular concrete wall has an adjustable window, whereas the one on the target room side is a one piece rectangular plate panel acting as a backstop for shrapnel and/or projectiles fired at the target. The steel plates are bolted together through the opening in the concrete wall. At the opposite (back) west wall end of this room there is a thick full length block of steel and a smaller thick square block piggy backed onto the steel plate panel making up the back wall. They would be in a projectiles path and act as backstops.

Building 611B Accessory Structures

- Uncovered accessory structure – sloping dirt ramp approximately 6 ft by 25 ft. It is heavily contaminated with metal and vegetation. It is bounded on the south, east, and west by cement walls. The south end is separated from the north end of the non-DU firing range by a concrete wall and five-sided catch box snuggled up against it on the north end wall of the non-DU firing range.

- Underground storage tank and fill pipe – 500-gal fiberglass tank located underground on the exterior south side of the instrumentation room. It is connected with dedicated plumbing to the dedicated washbasin/sink located on the north side of the instrumentation room. Its fill pipe, used for testing the water in the tank, extends up above the outside ground surface to the south of the instrumentation room.

- Outside open storage platform/deck (gazebo) – 12 ft by 6 ft platform/deck that has seriously degraded over the years is completely constructed of wood with a composite shingle roof supported by four (4 x 4) posts, wood side rails and no side panels. Several pieces of metal shims and targets were found on the flat wooden deck and the ground surface adjacent to this structure.

- Outside storage shelters – two modular and portable outside storage steel framed shelters are military communications trailers located on the outside and adjacent to the south side of the instrumentation room inside the boundary of the wetland.

- HEPA filtration/ventilation bank – multi-stage high efficiency particulate air (HEPA) filtration/ventilation bank positioned atop the inside storage area roof deck (app H). It contains four stages of filtration before discharging to the outside. A 6-in. duct extends from the HEPA bank out over the inside storage room roof and down, into the target room, through a penetration at the top center of the fifth and last section of the concrete pipe.

Building 611B Associated Grounds

- Associated grounds – The associated grounds are within a partially "enclosed" 40,000 ft^2 field, which consists of a paved entry way below the grade of the building to the south; an area on both sides of Bear Swamp Brook, which has a maximum width of a few feet and a flow rate of as much as 20 gal/min, to the east; and a fenced-in area to the north and west, which slopes down 10 to 20% towards the building located on the side of the hill. The unpaved areas are for the most part littered with spent munition shells and metal.

Operating History

The building 611B testing facility was designed for testing munitions and contained only non-radioactive munitions until approximately 1959 when the east-west testing range tunnel was built for small scale DU/staballoy munitions testing. From 1959 to 1979, there are no records available to substantiate the use/non-use of the facility. During operation, the safety measures taken to control the dispersion of radioactive material during impact were inadequate to ensure the proper engineered confinement of aerosolized and non-aerosolized DU. Discussions with personnel at the site revealed that some activities at the facility caused releases of material to the immediate area. The safeguards, however, appear to have been sufficiently effective to ensure consistently low exposures to personnel.

- One of the most important sources of release from a control standpoint was during operation of the HEPA system during firing. Thermally hot particulates of DU burned through the HEPA filtration/ventilation system causing ignition, excessive collection of particulates at the last stage of filtration, and the potential for the incomplete removal and uncontrolled emission of contaminates from this system. This was indicated by at least one reported fire in the HEPA filtration/ventilation bank. There was no monitoring of the exhaust ventilation for radioactive material. The direction of airflow from the HEPA system was toward the back (west) of the inside storage room, while its platform roof slopes toward the front of the room. Precipitation may have played a part in causing transfer of contaminates from the HEPA platform/roof/deck to the ground surface below.

- During firing, transferable/loose contaminates migrating from the target room to the inside of the building accumulated in some of the expansion joints between the poured concrete floor and walls, the seams between the floor tiles, and other locations outside the target room.

- The most significant migration of transferable/loose contaminates from the facility appears to have occurred by individuals tracking contaminates from the building to the inside storage room and vice versa. This was observed by detection of activity at the base of the stairs; in the soil under the stairs leading into the foyer; and on the ground in front of the entryway leading into the inside storage room, which possibly could have washed away and dispersed into the surrounding area.

- Also of significance, although not quantifiable, personnel reported that they observed a build up of pressure in the target room and the escape of particulates and dust into the DU/staballoy firing range tunnel and non-DU firing range through the fissures, penetrations, and openings between the circular concrete wall and steel plates, which divide the target room from the inside storage room. The firing events were described by ARDEC personnel as an explosion of material in the DU target room, which caused doors and steel hatched windows lining the east side wall of the non-DU firing range and window panes in the access doors leading into the foyer and loading area to either be stressed or to open during a firing. These comments caused us to take soil samples directly outside the hatched windows to determine the extent of contamination of the outside area.

Licensing

This characterization survey to identify DU(U-238) and its short-lived daughter products, the only radionuclides of concern, was conducted under the licensing authority [License number 27-29104-01, (app O)] held by GPL and granted by the United States NRC, which licenses and exerts its regulatory rules over this site in one with the New Jersey Department of Environmental Protection.

A Memorandum of Agreement was signed by GPI and the ARDEC Radiation Safety Officer (RSO) in order to facilitate cooperation of radiation protection aspects of their characterization survey protocol (app. P).

The total DU activity at the testing facility is conservatively estimated to be less than 1 mCi as determined from the characterization.

The average activity of DU in the 1.46E6 cm^2 (centimeters squared) ($10 * \pi * 50 * 12^2 * 2.54^2$) contaminated area in the DU firing range tunnel is approximately 10,000-dpm (disintergrations per minute)/100 cm^2, equal to 1.5E8 dpm or 6.6E7 pCi (picocuries) or 66 μCi (microcuries).

The activity in the non-DU firing range is estimated to be less than 10% of the DU firing range tunnel; i.e., 6.6 μCi.

The average activity of DU in the 4.4E6 cm^2 contaminated area of the HEPA ventilation system is estimated to be 20,000 dpm/100 cm^2, equal to 8.9E6 dpm/100 cm^2 or $8.9E^6$ dpm or 4E6 pCi or 4 μCi.

Characterization Process

Data was collected during the characterization survey by direct measurement of emissions from fixed contamination of the affected surfaces using count rate meters (Geiger Muller counters) and/or exposure rate meters (ionization chambers), and by collecting and analyzing filter disc samples from either the air samples used or the cloth smears used to manually wipe the potentially contaminated surfaces for transferable/loose contaminates. The latter two were counted using a laboratory grade low level alpha/beta counting system. Direct measurements and smear analysis provided an indication of the total fixed and/or removable (loose) level of contamination on the various surfaces monitored.

Waste-disposal Practices

Waste generation during the characterization of the facility was limited to protective/anti-contamination clothing, dusts from vacuuming, and contaminated items removed from inside and outside of the sections/components of the facility including wiring, metal targets, metal plate, metal tools, metal gun stands, and decontamination materials. As much as practical of the identified radioactive materials removed from the facility for decontamination or disposal was inventoried, double bagged, or placed in metal containers and controlled for temporary storage in one of the two outside steel storage shelters/military communication trailers (app A), which were posted and secured as appropriate. This will remain stored until a broker designated by the U.S. Army Field Support Command can re-identify, decontaminate if possible, and re-package all the radioactive material originating from this characterization survey and future decommissioning/remediation actions into Department of Transportation (DOT) approved containers [e.g., 7.5 ft^3 55-gal drums, 95 ft^3 B-25 boxes, or 675 ft^3 (25 yd^3) intermodals] properly surveyed, weighed, labeled, and manifested prior to on-post transfer, license-to-license transfer, and/or ultimate off-post DoD authorized disposal.

As practical, protective clothing and equipment waste generated during this project were frisked for release as clean waste to ensure that waste volume was minimized. More than 540 ft^3 (20 yd^3) of clean material was released from the site for a coordinated turnover to the appropriate organization at Picatinny for processing.

SURVEY INSTRUMENTS AND TECHNIQUES

The surveys completed during the characterization study involved detection of beta and gamma radiation with portable and semi-portable instruments in order to control and adequately determine the radiation levels due to fixed and/or loose contamination incident to the testing of DU/staballoy munitions, to evaluate the site for compliance, and provide the background information needed to remediate and decommission the facility, remove it from ARDEC's SUB-348 NRC license, and free it from radiological control.

NOTE: Although ^{238}U is an alpha emitter, the most important radiations emitted from a characterization standpoint are beta and gamma emissions from the ^{234}Th, ^{234m}Pa, and ^{234}Pa daughter products. Radon and radon daughters are not a concern from the DU remaining from testing of scaled down DU/staballoy projectiles because the half-life of ^{234}U is sufficiently long to prevent substantial creation of radium and its daughters, and the relative time since the separation of DU from natural uranium is not significant compared to the half-life of ^{234}U (2.5E5 yrs).

Instruments on-site for this evaluation were designed for control of radioactive material and for characterization of the levels of fixed and removable contamination on surfaces.

- Ludlum Model 3 rate meters with Model 44-9 probes (GM pancake)
- Ludlum Model 19 with 1-in. by 1-in. internal sodium iodide detectors
- Ludlum Model 2221 rate meter/scaler with 44-89 probe (alpha/beta scintillation)
- Ludlum Model 2224 rate meter/scaler with 44-89 probe (alpha/beta scintillation)

INITIAL CONDITIONS

Prior to characterization of the testing facility, the initial physical and radiological conditions are described in the following paragraphs.

Initial Physical Conditions

The physical structure of building 611B, which contains materials and equipment to conduct firing operations and ballistic tests, is deteriorating. Even with signs of deterioration, such as the roof leakage and presence of carpenter ants in the instrumentation room, the structure is sufficiently sound to allow work.

The outside, open, storage platform/deck is a deteriorating wood frame structure that has been affected by the harsh weather of New Jersey and is not safe for routine use.

The two outside military communications shelters/trailers are metal and solid.

The grounds on the north and east sides of building 611B are littered with outdated potential UXO. This ordnance was marked and identified by UXO certified personnel for removal and disposition by the local Explosive Ordnance Disposal (EOD) and Technical Division.

Initial Radiological Conditions

Fixed and/or loose surface contamination due to alpha/beta/gamma radiation exists primarily in the HEPA filtration system, the DU target room, and the DU firing range tunnel. All other areas were essentially free of either fixed or removable/loose surface contamination or showed activities near the established limits.

The highest activities identified throughout building 611B were in the DU target room and DU/staballoy firing range tunnel. Activities in other sections of the building were spotty and found primarily during the characterization when equipment and materials were removed from the building.

The materials, equipment, and furniture in the non-contaminated areas of building 611B were found to be relatively free of surface contamination associated with the ballistics testing of small scale DU/staballoy, kinetic penetrator, armor piercing operations. Most of these items were released from the facility as clean after being surveyed. Those materials found to be contaminated were packaged, identified, and handled as described under the heading of Waste Disposal Practices previously discussed.

CHARACTERIZATION

Work Site Preparation

Prior to initiating the characterization study, the building 611B testing facility, was surveyed by certified UXO experts for the presence of UXO, which may have been present as a result of past operations at the facility. The UXO report from that survey is included with this publication at appendix L.

All of the GPI workers involved with the project reviewed and discussed the Project Work Plan, HASP, QA plan, scope of work, and radiological requirements for control of the work prior to beginning project related activities.

Air Sampling

Low volume (2 cfm) air sampling pumps were placed in the work area of the DU/staballoy firing range tunnel and outside building 611B to collect a background airborne radiological air sample on filter discs for comparison purposes. The work area air sampler was relocated within the different work areas to obtain representative breathing zone airborne samples.

There was never any indication of airborne radioactive particulates during the work. Respiratory protection devices were not used for this characterization work.

Characterization Surveys

Physical characterization efforts began on 14 April 1997. All loose material/debris removed from the floor area as well as the loose wiring systems and signal wires disconnected from the x-ray systems in the DU/staballoy firing range tunnel were inventoried, packaged, and

handled as described under the heading of Waste Disposal Practices. Large, heavy items were moved as practical to the non-DU firing range to reduce background dose rates in the areas being characterized. Recommended remediation methods are discussed later in this report.

A compilation of the radiological and explosive survey data for each area of the site is included in appendices A through J, L, and Q through T.

Foyer

Dust and soil in the seams between the floor tiles include DU particulates from the firing operations. Samples of the tile and paint from the walls were taken and analyzed for asbestos and lead, respectively, by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.

Instrumentation Room

There are four areas of radiological concern in this room:

- The floor and walls near the location of the sink had two small areas of activity. The sink was removed, packaged, and handled as described under the heading of Waste Disposal Practices.

- The seams between the vinyl floor tile had transferable/loose contaminates with dust, soil, and DU particulates from the DU/staballoy firing operations. Samples of the floor tile and paint from the walls were taken and analyzed for asbestos and lead, respectively, by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.

- Grid SC2 (app C) had a high reading due to the presence of the stem piece for the drain to the UST. It was left in place because a small amount of building removal is required to remove this item

- Penetrations on the west wall (interfacing to the non-DU tunnel) there into the non-DU firing range that have flat horizontal surfaces were found to be collecting points for loose contamination.

Non-DU Firing Range

Depleted uranium projectile fragments and/or transferable contaminates from the DU/staballoy firing operations were found with dust, soil, and/or DU particulates that collected on or in:

- Horizontal surfaces such as electrical conduit, electrical boxes, electrical conduit raceways, lights, and around the crevices between the structural concrete and steel plates making up the five-sided open catch box or on the floor under various DU operations-related hardware.

- Seams between the vinyl floor tile. Samples of the floor tile and paint from the walls were analyzed for asbestos and lead, respectively by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.

- Expansion joints around the concrete slope at the catch box north end of the non-DU firing range.

A large drum present in the bullet catch box is filled with sand. Although there were no readings on the drum that indicate the presence of activity above natural background, the drum will have to be emptied during the remediation phase.

Depleted Uranium Firing Range Tunnel

Collecting points for the DU projectile fragments and/or transferable/loose contaminates (e.g., dust, soil and/or DU particulates) from the DU/staballoy firing operations in this section were the:

- Seals connecting the sections of pipe making up the DU firing range tunnel that have deteriorated and have been patched over.

- Floor surfaces at the interface with the wall, other wall and floor surfaces and the lighting and electrical fixtures.

- Seams between the vinyl floor tile. Samples of the floor tile and paint from the walls were analyzed for asbestos and lead, respectively by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.

- Inside un-tiled floor under the large steel gun mount. It is anticipated that this inaccessible area is the "hiding place" for several small-scale DU projectile fragments.

- One-holed circular steel door/wall dividing the DU firing range tunnel from the target room that will require removal for decontamination or disposal as radioactive waste.

Depleted Uranium Target Room

The areas of radiological concern in this room are:

- Openings due to the absence of seals between the circular steel wall/door that divide the target room from the DU firing range tunnel, and the concrete frame of the pipe and openings has allowed for dispersal of DU particulates and dust during firing into the DU firing range tunnel.

- All of the DU target room's infrastructures and infrastructure interfaces that are contaminated with DU.

- The space between the gun mount and floor that is a hiding place for projectile fragments.

- The two exposed, un-paneled circular concrete sidewalls that show signs of severe degradation due to the impact of projectiles and target fragments.

- The steel plate on the target room side in front of the circular concrete wall that has several penetrations including some made by scaled down projectiles.

- All metal frames and hardware that will be packaged, inventoried, and handled under the heading of Waste Disposal Practices.

- The open end of the 4-in. diameter duct extending into the target room that was taped to confine any of the transferable/loose contamination from the inside of the exteriorly mounted HEPA ventilation system. The latter showed more activity than any other location during the characterization study.

Inside Storage Area

Transferable contaminates (e.g., projectile fragments and dust) migrated into the inside storage room through the unsealed adjustable window on the east end of this room and were found in the wall and settled on the horizontal faces of the steel blocks attached to the back/west wall.

Materials stored in the inside storage room were found to be contaminated (app S). These contaminating radioactive materials probably caused DU contamination of some of the floor surfaces and subsequently some of the shoes of personnel accessing the room. Personnel traffic then resulted in the limited migration of the DU into the soil directly outside the room.

Underground Storage Tank (UST)

The cover of the UST fill pipe was removed for evaluation of the tank contents. A frisk survey of the threads on the inside of the pipe indicated the presence of activity above background (approximately 100 counts per minute). This potentially indicates that an overflow of the tank occurred in the past. Soil samples in the area indicate that most of the released contaminate was removed or dispersed from the area.

Samples of the silt and soil that collected in the tank over the years also indicates the presence of DU activity with count rates of 50 to 100 counts per minute above background. It is not anticipated that the water, when sampled, would provide any indication of radiologicals associated with the operations conducted at the testing facility. However, since a smear sample of the inside of the tank did indicate the presence of removable contamination, the tank should be considered for removal during the remediation of the facility.

Outside Open Storage Platform

The structure was monitored to determine the level of radiation and radioactive contamination. Due to the weakness of the structure, the raised, horizontal, wooden, flat surfaced deck could not be removed without compromising its integrity. Many pieces of wood under the platform will require removal and survey for release during the remediation phase.

- Materials stored on this platform caused minor contamination of its wooden, flat surfaced deck. This flat surface floor was painted during the characterization to fix the activity in place until the affected piece of plywood deck could be removed and disposed of as low activity radioactive waste. That deck was not removed because the stability of the entire platform would be seriously compromised by the lack of a deck. It is not considered likely that activity above limits is present beneath the deck.

- All contaminated materials found were inventoried, packaged, and handled as described under the heading of Waste Disposal Practices.

Outside Storage Shelters

No remediation effort is required for these two shelters/trailers. The one used to store the packaged radioactive material removed from the building 611B testing facility prior to the site characterization survey is properly secured and posted while the other remains empty and padlocked.

Building 611B Associated Grounds

Fifty soil samples were collected in several areas to demonstrate the likely migration of radioactive materials from building 611B and accessory structures. Levels of DU activity in the surface soil range from levels consistent with background to as much as approximately 107 pCi/g. Of all the samples, four exceeded the remediation level of 35 pCi/g with the soil under the stairs leading into the foyer with the highest concentration of DU activity. Seven samples have detectable DU activity between background and the remediation level, and the remainders are consistent with background. The contaminated soil with DU transferable contaminates in this area along with the contaminated soil in other areas will have to be excavated until the area samples show activities below the action level. Contaminated soil is packaged, and handled as described under the heading of Waste Disposal Practices. Refer to the sample results table (app. S)

RADIOACTIVE WASTE STREAM INFORMATION

Type of Waste and Packaging

All contaminated materials found were inventoried, packaged, and handled as described under the heading of Waste Disposal Practices. No liquids requiring treatment or disposal were generated in this phase of the work. No sampling for the presence of hazardous materials was done at the site.

Disposal Information

The approximate volume of waste generated thus far is 256 ft^3 (excluding soil volume and other radioactive materials or low activity mixed radioactive materials resulting from any future decommissioning remediation action). The final burial volume from this phase of the decontamination may be less if metal processing to remove DU activity from item surfaces is pursued. Hazardous materials discovered at the site were provided to the on-post Industrial Hygienist for disposition.

RECOMMENDED REMEDIATION STRATEGIES

Remediation Methods

Experienced personnel should accomplish decontamination of the concrete surfaces of the structure in the DU firing range tunnel and target room using scabbling techniques. It is anticipated that scabbling to a depth of 1 cm (2 in.) will be adequate to remove the activity from the concrete surface.

Decontamination of other surfaces, such as the tile and floor will be completed by removal of the tile and cleaning the exposed surfaces. If lead or asbestos containing materials (ACM) or other hazardous materials are identified from the samples taken from the floor, then standard industry control measures for ACM or the other hazardous materials must be identified in the remediation work plan and used to prevent unnecessary exposure to the material.

No new work processes will be attempted during the remediation phase of this project.

Recommended Work Breakdown

Remediation of the foyer would require removal of the floor tile and mastic. No other decontamination appears necessary for this area.

Remediation of the instrumentation room should consist of removal of the sink drain, floor tile, and mastic, decontamination of the affected walls and penetrations.

Remediation of the non-DU firing range will require removal of all contaminated components, removal of the floor tile and mastic, scabbling of the wall surfaces with fixed contamination paying special attention to the horizontal surfaces on top of the concrete walls, removal of contaminated concrete from cracks and the wall to floor joints, and dismantling and removal of the large steel catch box positioned against the north wall end of the non-DU firing range.

Remediation of the DU firing range tunnel will require removal of all contaminated components, removal of the floor tile and mastic, scabbling of all wall surfaces with fixed contamination, removal of contaminated concrete from cracks and the wall to floor joints, removal of the gun mount (possibly decontamination and cutting it into pieces before removal), and removal of the circular steel wall/door separating the DU firing range from the DU target room.

Remediation of the DU target room will require removal of all steel components, scabbling of the concrete floor surface, scabbling of all wall surfaces, removal of the contaminated concrete from cracks and the wall to floor joints, decontamination or removal of the circular concrete wall with its anchored front and back steel plates.

Remediation of the inside storage room will require removal of all contaminated components, removal or decontamination of contaminated steel structures such as metal wall panels and backstops, scabbling of all contaminated concrete wall and floor surfaces with fixed contamination, removal of contaminated concrete from the cracks and the wall to floor joints, and removal of the contaminated circular concrete wall with its anchored front and back steel plates.

Remediation of the outside, open, storage platform will simply require removal of contaminated flat wooden decking. The plywood and floor joists can be removed, but it may be necessary for the structure to be demolished after removal or new structural members be placed to prevent the structure from accidentally falling.

No remediation is required for the two steel frame military communications trailers adjacent to building 611B, of which one is being used as a temporary outside storage shelter for the low activity radioactive materials removed from the facility.

Waste Minimization During Remediation

Waste generation for the remediation of the building 611B testing facility will be limited to protective clothing, dusts from vacuuming and scabbling, soil, HEPA filters, old packaging for contaminated materials, the UST transferable contamination (if it is cleaned), and metal and wood materials used for targets and construction materials. The contaminant is mainly limited to the DU target room, DU firing range tunnel, HEPA filtration/ventilation bank, and contaminated components throughout the facility; i.e. Building 611B, accessory structures, and associated grounds. Waste generated will be handled, inventoried, and packaged as described under the heading of Waste Disposal Practices and temporarily stored in or outside of building B312, the Radioactive Materials Storage and Handling Facility awaiting ultimate disposal.

As practical, protective clothing and equipment wastes that are generated during this project will be frisked for release as clean waste to ensure that waste volume is minimized.

The Radiation Protection Office designee will stage clean materials at the site in a designated clean area for removal.

CONCLUSIONS

As a result of the effort by Gutierrez-Palmenberg, Inc., Joe Fabiano of the Army Armament Research, Development and Engineering Center (ARDEC), Picatinny, New Jersey and Mike Styvaert of the Army Field Support Command, formerly the Industrial Operations Command, the Building 611B Testing Facility at ARDEC has been characterized for the presence of depleted uranium in accordance with the work description of contract DAAA09-95-G-0017.

APPENDIX A

LOW ACTIVITY RADIOACTIVE MATERIAL INVENTORY (STORAGE)

ARDEC Picatinny Arsenal

Building 611B Characterization

Radioactive Material Inventory

Notes

1. Packages are double bagged and stored in the portable storage area labeled #2
2. Dose rates on packages are based on contact readings with a gamma radiation detector and are uR/hour.
3. Bag weight is reported in pounds based on estimates from workers.

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Radioactive Material Inventory

Bag #	Contents	Weight (Pounds)	Dose Rate µR/hour
1	hose and light covers	10	10
2	misc. paper products 2 pieces steel stock misc. rubber pushers small piece of hose sink drain 2 spools of wire pair of shoes pair of gloves	15	15
3	sink	10	7
4	plastic floor mat garbage can gloves paper	10	7
5	9 X ray tubes	3	18
6	garbage can ammo box with misc. parts	20	7
7	4' angle iron	5	7
8	2' X 2' plywood	8	7
9	1' X 2.5' metal shelf	10	7
10	2' X 2' plywood	8	7
11	2' X 6.5' plywood	10	8
12	4 2" X 6' PVC pipe	10	7
13	bag of trash	10	7
14	2 large c-clamps	15	7
15	2 large c-clamps	15	7
16	3 pieces of wood	20	28
17	3 x ray guns	15	7

Bag #	Contents	Weight (Pounds)	Dose Rate µR/hour
18	4 c-clamps tape dispenser level 1 glove	20	7
19	tool box misc. tools	15	7
20	trash	10	8
21	1 file 3 small c-clamps misc. scrap metal	20	7
22	25 pieces of plywood	20	8
23	misc. tools scrap metal steel plate	50	8
24	ammo box	25	8
25	2 large c-clamps	15	7
26	nuts and bolts lead x ray letters brush magnet	26	9
27	steel plate c-clamp	45	8
28	steel plate	50	8
29	gun breach nuts and bolts counter weights	30	7
30	trash	10	7
31	wire	15	7
32	wire	15	8
33	wire	15	8
34	wire	10	7

Bag #	Contents	Weight (Pounds)	Dose Rate µR/hour
35	wire	10	7
36	wire	15	7
37	wire and trash	10	7
38	wire	20	7
39	wire	12	7
40	wire	5	8
41	wire	15	7
42	wire	15	7
43	3 steel plates targets	75	7
44	steel plates targets	60	8
45	steel plates targets	75	7
46	6 x ray guns	30	19
47	4 x ray guns	20	13
48	4 x ray guns	20	12
49	steel plate (target)	60	7
50	box steel	15	7
51	wood	20	9
52	misc. scrap steel	10	7
53	steel plates (targets)	70	7
54	misc steel (scrap)	40	18
55	trash	25	7
56	bottom of cabinet	10	7
57	cabinet sides (2)	40	8
58	steel angle iron	10	8

Bag #	Contents	Weight (Pounds)	Dose Rate µR/hour
59	steel angle iron	10	8
60	steel	100	7
61	stock steel bars	40	7
62	wood table top	15	8
63	5 2x6x7	20	7
64	wood	8	16
65	steel plate	50	11
66	angle iron	10	7
67	steel plate	25	7
68	thin steel plate	2	10
69	misc steel	2	48
70	ammo box misc items	30	8
71	plexi glass	10	8
72	bag of trash	10	9
73	wood	1	7
74	ammo can	35	7
75	ammo can	30	7
76	ammo can	20	9
77	ammo can	15	8
78	ammo can	15	8
79	steel stock	30	7
80	1 4"x 30"x 1" steel	25	7
81	1 4"x 30" x 1" steel	25	12
82	2 4"x 12" x 1" steel	25	7
83	plywood 20"x 10' x 3/4"	20	7

Bag #	Contents	Weight (Pounds)	Dose Rate µR/hour
84	plywood 20"x 5' x 3/4"	10	7
85	steel 1/2" x 6" x 12"	5	7
86	steel 2" x 6" x 6"	20	40
87	steel 2" x 8" x 8"	30	50
88	steel 2" x 8" x 8"	30	7
89	steel 2" x 10" x 10"	40	30
90	steel 2" x 8" x 8"	30	8
91	steel 2" x 8" x 8"	30	7
92	rubber floor mats	40	7
93	½ target mounts	100	10
94	½ target mounts	80	15
95	18" X 12" X 1/4" steel	5	7
96	trash	3	8
97	wood	10	8
98	aluminum plates	40	8
99	fan	10	7
100	2 ammo box wood box	40	8
101	ammo box wood box	30	7
102	pipe	10	8
103	steel pipe 18" x 3/4"	5	7
104	ammo box shims and bolts	10	7
105	2" x 2" x 6' channel	30	7
106	plywood 20" X 30" X ½	5	7
107	wood box nuts and bolts	40	8

Bag #	Contents	Weight (Pounds)	Dose Rate µR/hour
108	trash	20	6
109	trash	40	6
110	trash	40	6
111	plate steel	170	7
112	trash	10	11
113	plexi glass	10	6
114	steel plate	30	6
115	bag of trash	10	8
116	trash	20	7

APPENDIX B

ANALYSIS OF DATA FOR BUILDING 611B FOYER

ARDEC Picatinny Arsenal

Building 611B Characterization

611B Foyer

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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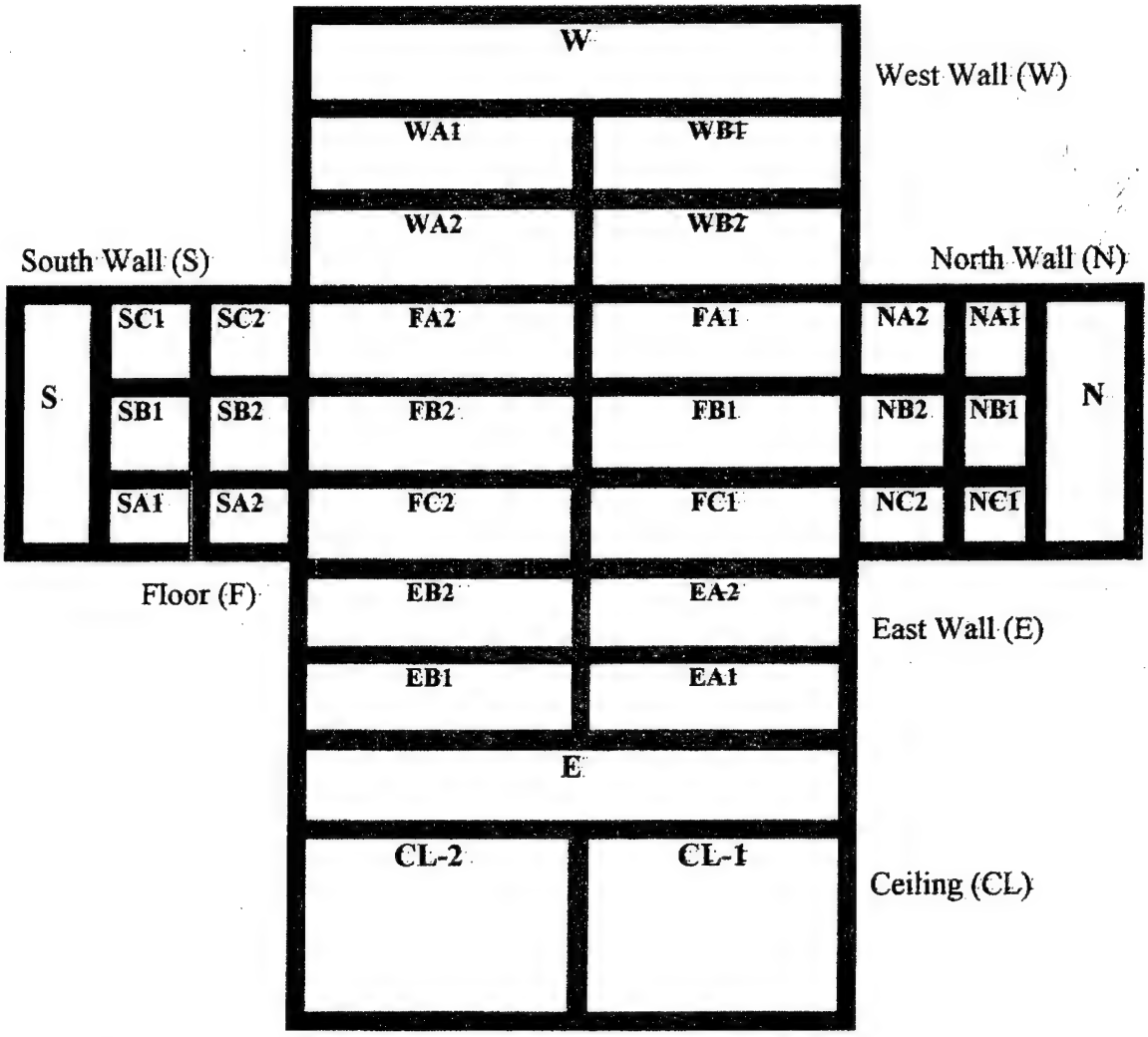

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Table FR-1

ARDEC Picatinny Arsenal
Survey Number: GPI-S-024 Large Probe
Location: 611B Foyer - Unaffected area

Detection efficiency 0.17 c/d
Background = 300 cpm

Gross instrument response (cpm)

	1	2
N	300	
E	307	
S	303	
W	300	
Ceiling	300	300

Estimated activity based on efficiency and backgrounld stated above dpm/100 square cm

	1	2
N	0	
E	41	
S	18	
W		
Ceiling	0	0

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-024 Large Probe
Location: 611B Foyer West wall

Detection efficiency 0.17 c/d
Background = 300 cpm

Gross Instrument response (cpm)

	1			2		
A	300		300	300		300
		300			300	
	300		300	300		300
B	300		300	300		300
		300			300	
	300		300	300		300

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1			2		
A	0		0	0		0
		0			0	
	0		0	0		0
B	0		0	0		0
		0			0	
	0		0	0		0

Note: Readings less than background (300 cpm) were recorded as 300 cpm

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-024 Large Probe
Location: 611B Foyer - North wall

Detection efficiency 0.17 c/d
Background = 300 cpm

Gross Instrument response (cpm)

	1			2		
A	310		323	325		354
		300			300	
	330		344	300		315
B	361		347	371		300
		300			328	
	300		308	356		338
C	311		300	309		324
		307			300	
	300		300	300		318

Estimated activity based on efficiency and background stated above
dpm/100 square cm

	1			2		
A	59		135	147		318
		0			0	
	176		259	0		88
B	359		276	418		0
		0			165	
	0		47	329		224
C	65		0	53		141
		41			0	
	0		0	0		106

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-024 Large Probe
Location: 611B Foyer - Floor

Detection efficiency 0.17 c/d
Background = 300 cpm

Gross instrument response (cpm)

	1		2	
A	100	110	300	170
	300		304	
	220	250	200	70
B	200	300	180	100
	300		300	
	70	180	150	80
C	60	120	100	90
	311		311	
	70	120	150	80

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1		2	
A	0	100	2000	700
	0		24	
	1200	1500	1000	-300
B	1000	2000	800	0
	0		0	
	-300	800	500	-200
C	-400	200	0	-100
	65		65	
	-300	200	500	-200

= pancake probe GM response (cpm) detection efficiency ~ 10%, results approximated as dpm/probe area

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

APPENDIX C

ANALYSIS OF DATA FOR INSTRUMENTATION ROOM

ARDEC Picatinny Arsenal

Building 611B Characterization

Instrumentation Room

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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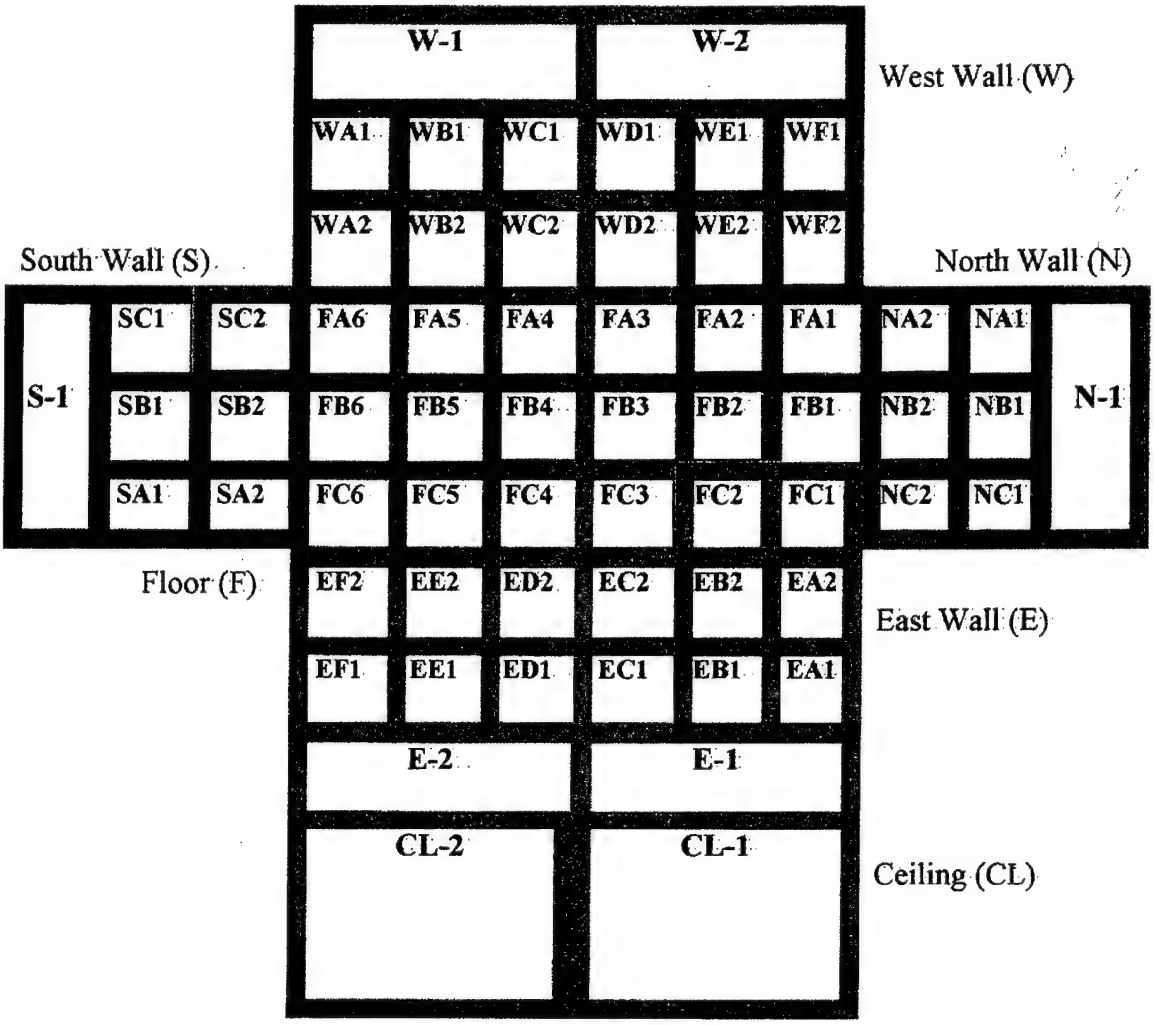
ARDEC Picatinny Arsenal *Instrument Room Grid Layout*



= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Table IR-1

ARDEC Picatinny Arsenal
Survey Number: GPI-S-024 Large Probe
Location: 611B Instrument Room Unaffected Areas (Upper walls & Ceiling)

Detection efficiency 0.17 c/d
Background = 300 cpm

Gross Instrument response (cpm)

	1			2		
N	300		300			
		316				
	380		329			
E	352	354		357	347	
		346				334
	310		348	343	345	
S	337	319				
		300	348			
	350					
W	300	300		401		
		300	359		372	429
			376	314		404
Ceiling	313			300		300
		330	300		314	
	302		300	318		329

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1			2		
N	0		0			
		94				
	471		171			
E	306	318		335	276	
		271				200
	59		282	253	265	
S	218	112				
		0	282			
	294					
W	0	0		594		
		0	347		424	759
			447	82		612
Ceiling	76			0		0
		176	0		82	
	12		0	106		171

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-022 Large Probe
Location: 611B Instrument Room Floor

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (cpm)

	1			2			3			4			5			6		
A	440			478		451	421			434		448	436		422	355	336	
	403		482			460		413	428	450		424			489	359		
		458	447		397	441	401		377		445		497		447	343	409	
B	447		658			360	349		376		393	379	353		360	357	346	
	433			336		353		370			389			336			373	
	409		489		357	344	347		341	357		367	357		344	313	438	
C	484		558	404		478	492		520	368		401		403		355	336	
			530			504		494			421		349		385		378	
	442	603		462		458	407		470	397		421		417	386	389	401	

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1			2			3			4			5			6		
A	824			1047		888	712			788		871	800		718	324	212	
	606		1071			941		665	753	882		729			1112	347		
		929	865		571	829	594		453		853		1159		865	253	641	
B	865		2106			353	288		447		547	465	312		353	335	271	
	782			212		312		412			524			212			429	
	641		1112		335	259	276		241	335		394	335		259	76	812	
C	1082		1518	612		1047	1129		1294	400		594		606		324	212	
			1353			1200		1141			712		288		500		459	
	835	1782		953		929	629		1000	571		712		688	506	524	594	

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-023 Large Probe
Location: 611B Instrument Room North Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (CPM)

	1			2		
A	443		452	425	407	
	432	418	421	435		427
	416		423			410
B	464		401	406		
	413		420	414	408	
		400	405	403		404
C	440	417	397	446		395
	431	452	443	426	400	433

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1			2		
A	841		894	735	629	
	776	694	712	794		747
	682		724			647
B	965		594	624		
	665		706	671	635	
		588	618	606		612
C	824	688	571	859		559
	771	894	841	741	588	782

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-027 Large Probe
Location: 611B Instrument Room West Wall

Detection efficier 0.17 c/d
Background = 300 cpm

Gross Instrument response (CPM)

	1			2		
A	300	300		300		300
			300		327	
	402		420	405		417
B	445		305	364		
		300			547	502
	323		331		439	467
C	410		456	408		422
		426			450	
	418		413		477	394
D	414		480	402		405
		487	409	390		398
		358		417		
E			436			377
	432	430	427	363	352	
		371		368		385
F	427					413
		384	384	342		390
	398		380		423	401

Estimated activity based on efficiency and background stated - dpm/100 square cm

	1			2		
A	0	0		0		0
			0		159	
	600		706	618		688
B	853		29	376		
		0			1453	1188
	135		182		818	982
C	647		918	635		718
		741			882	
	694		665		1041	553
D	671		1059	600		618
		1100	641	529		576
		341		688		
E			800			453
	776	765	747	371	306	
		418		400		500
F	747					665
		494	494	247		529
	576		471		724	594

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-025 Large Probe
Location: 611B Instrument Room East Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (CPM)

	1			2		
A	443		484		478	
		405		504	404	458
	442	658			462	
B	489		475	502		501
		487			494	
	436		497	402		470
C	342		343	397		368
		359			401	
	336		355	421		421
D	360		353	385		349
		336			386	
	357		344	417		403
E	376		349	379		393
		370			389	
	347		441	363		357
F	356		353	346		357
		383			373	
	386		397	331		383

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1			2		
A	841		1082		1047	
		618		1200	612	929
	835	2106			953	
B	1112		1029	1188		1182
		1100			1141	
	800		1159	600		1000
C	247		253	571		400
		347			594	
	212		324	712		712
D	353		312	500		288
		212			506	
	335		259	688		606
E	447		288	465		547
		412			524	
	276		829	371		335
F	329		312	271		335
		488			429	
	506		571	182		488

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-026 Large Probe
Location: 611B Instrument Room South Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (CPM)

	1			2		
A	373		337	394		346
		381			371	
	352		365	378		399
B	343		356			300
		256			365	367
	270		261	402		300
C	377		400	476		
		352	408		495	
		384		527	457	4713

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1			2		
A	429		218	553		271
		476			418	
	306		382	459		582
B	253		329			0
		-259			382	394
	-176		-229	600		0
C	453		588	1035		
		306	635		1147	
		494		1335	924	25959

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

APPENDIX D

ANALYSIS OF DATA FOR NON-DU FIRING RANGE

ARDEC Picatinny Arsenal

Building 611B Characterization

Non-DU Firing Range

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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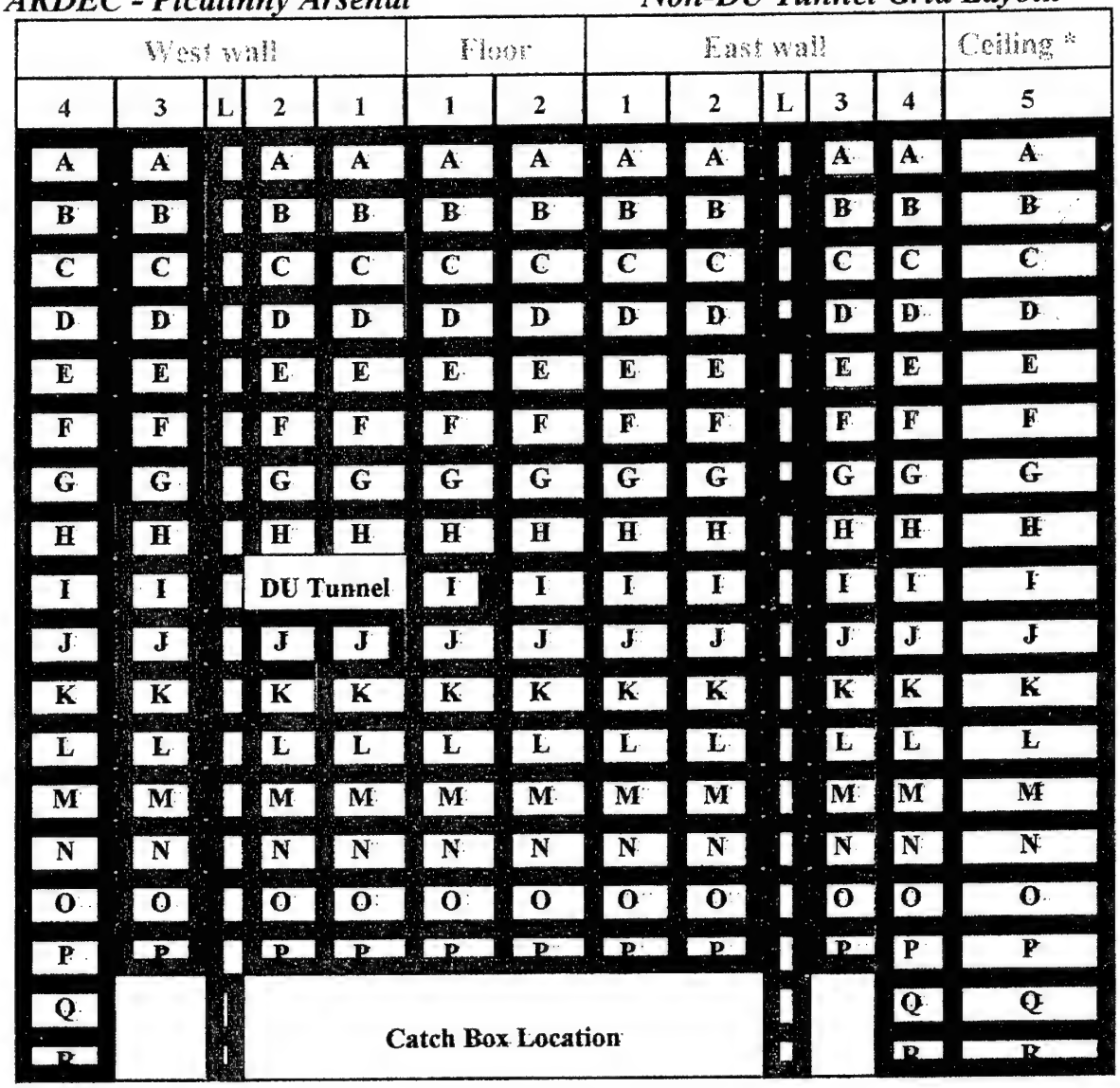
Las Vegas, NV 89106
702-647-5699

ARDEC - Picatinny Arsenal *Non-DU Tunnel Grid Layout*



Grids 4 on the West and East walls are also a part of the ceiling.
L = Ledge on West and East walls.

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Table NDU-1

RDEC Picatinny Arsenal
Survey Number: GPI-B-098 Large Probe
Location: Inside Non-DU Tunnel East Wall Ledge

Detection efficiency = 0.17 c/d
Background = 200 cpm

Instrument Response (CPM)

	A			B		C			D			E			F			G			H		
3	247	245	249	236	240	293	250	247	246	251	245	247	478			713	576	504	690	510	520		1352	853

Activity Concentration (dpm/100 square cm)

	A			B		C			D			E			F			G			H		
3	276	265	283	212	235	547	294	276	271	300	285	278	1835			3018	2212	1788	2882	1824	1882		6776	3841

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Instrument Response (CPM)

	I			J		K			L			M			N			O			P		
3	1451			1459	1661	1351	1147	2137	1139	1803	1687	1717	1274	1245	1487	1810	2042	1549	2553	2223	1590	1326	1291	1243

Activity Concentration (dpm/100 square cm)

	I			J		K			L			M			N			O			P		
3	7359			7406	8594	6771	5571	11394	5524	9429	8747	8924	6318	6147	7571	9471	10835	7935	13841	11900	8176	6824	6418	6135

	Q			R	
3	2029	1928	1788	1755	1904

	Q			R	
3	10759	10165	9341	9147	10024

RDEC Picatinny Arsenal
Survey Number: GPI-S-071 Large Probe
Position: Ceiling of Non-DU Tunnel

Detection efficiency = 0.17 a/d
Background = 200 cpm

West Wall Ceiling

Instrument Response (CPM)

	A	B	C	D	E	F	G	H
1	247	251	260	251	246	257	224	223

Activity Concentration (dpm/100 square cm)

	A	B	C	D	E	F	G	H
1	276	300	353	300	271	335	141	135

Instrument Response (CPM)

	I	J	K	L	M	N	O	P	Q	R
1	215	235	237	222	197	207	227	179	227	211

Activity Concentration (dpm/100 square cm)

	I	J	K	L	M	N	O	P	Q	R
1	88	208	218	129	-18	41	159	-124	159	65

East Wall Ceiling

Instrument Response (CPM)

	A	B	C	D	E	F	G	H
1	270	278	275	272	285	273	255	258

Activity Concentration (dpm/100 square cm)

	A	B	C	D	E	F	G	H
1	412	459	441	424	382	429	324	329

Instrument Response (CPM)

	I	J	K	L	M	N	O	P	Q	R
1	235	256	219	230	199	218	228	272	235	210

Activity Concentration (dpm/100 square cm)

	I	J	K	L	M	N	O	P	Q	R
1	206	329	112	229	-6	106	165	424	206	59

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-069 Large Probe
Location: Non-DU Tunnel Ceiling

Detection efficiency = 0.17 c/d
Background = 200 cpm

Instrument Response (CPM)

	J	K	L	M	N
5	242	211	225	229	227

Activity Concentration (dpm/100 square cm)

	J	K	L	M	N
5	247	65	147	171	159

Instrument Response (CPM)

	O	P	Q	R
5	225	223	209	221

Activity Concentration (dpm/100 square cm)

	O	P	Q	R
5	147	135	53	124

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-050 Large Probe
Location: Non-DU Tunnel South Wall

Detection efficiency = 0.17 c/d
Background = 170 cpm

Instrument Response (CPM)

	A			B		
1	368		210	224		413
		212			200	
	369		226	216		356
2	350		204	206		328
		202			192	
	366		191	211		388
3		323	318	349	309	
		290			343	
	356		298	300		290

Activity Concentration (dpm/100 square cm)

	A			B		
1	368		210	224		413
		212			200	
	369		226	216		356
2	350		204	206		328
		202			192	
	366		191	211		388
3		323	318	349	309	
		290			343	
	356		298	300		290

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-031 Large Probe
Location: Non-DU Tunnel Floor

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)

	A		B		C		D		E		F		G		H	
1	338	316	320	613	912	400	322	320	317	410	488	300	334	366	559	528	964
	512		713	317	305	523	489	603	300	317	305	440	503	300	359	417	720
2	327	989	394	1038	300	330	331	347	364	370	453	444	332	671	428	771	520
	586		385	337	360	450	300	334	355	312	449	562	509	360	376	703	537

Activity Concentration (dpm/100 square cm)

	A		B		C		D		E		F		G		H	
1	224	94	118	1841	3600	588	129	118	100	647	1106	0	200	388	1524	1341	3906
	1247		2429	100	29	1312	1112	1782	0	100	29	824	1194	0	347	688	2471
2	159	4053	553	4341	0	176	182	276	376	412	900	847	188	2182	753	2771	1294
	1682		500	218	353	882	0	200	324	71	876	1541	1229	353	447	2371	1394

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Instrument Response (CPM)

	I		J		K		L		M		N		O		P	
1	636	1320	551	569	790	1482	583	1540	3771	1296	1388	1160	1474	1271	1262	604	873
	896		418	2387	577	682	598	680	756	1480	2175	1528	1309	1024	1152	1458	1247
2	702	460	616	530	535	457	845	3098	1696	1337	1435	1384	1738	1473	1514	855	777
	441		508	697	663	646	561	676	974	2219	2214	1194	1590	1185	1439	1289	1444

Activity Concentration (dpm/100 square cm)

	I		J		K		L		M		N		O		P	
1	1976	6000	1476	1582	2882	6953	1665	7294	20418	5859	6400	5059	6906	5712	5659	1788	3371
	3506		694	12276	1629	2247	1753	2235	2682	6941	11029	7224	5935	4259	5012	6812	5571
2	2365	941	1859	1353	1382	924	3206	16459	8212	6100	6676	6376	8459	6900	7141	3265	2806
	829		1224	2335	2135	2035	1535	2212	3965	11288	11259	5259	7588	5206	6700	5818	6729

ARDEC Picatinny Arsenal
Survey Number: GPI-SI-053 Large Probe
Location: Inside Non-DU Tunnel East Wall

Detection efficiency = 0.17 cpd
Background = 200 cpm

Instrument Response (CPM)

	A		B		C		D		E		F		G		H	
1	376	378	343	387	391	340	391	424	452	406	2583	432	399	466	473	420
2	377	414	390	404	300	300	320	408	320	394	425	662	618	561	520	389
3	360	257	380	332	330	300	312	370	313	386	391	427	414	435	420	397
4	401		370		417	463	467	447	450	533	509	472	407	417	418	367
5	240		265		298	231	243	229	207	228	222	249	256	240	214	235
	333		320		367	319	309	342	290	223	352	402	255	438	377	445

	I		J		K		L		M		N		O		P	
1	422	436	394	391	331	544	498	382	391	454	390	432	346	387	420	331
2	409	344	421	408	405	503	504	652	619	462	407	587	436	791	968	915
3	382	320	391	426	426	463	417	633	432	602	611	339	359	377	371	387
4	242	372	250	313	297	241	268	375	300	334	302	318	267	494	262	314
5	504		463	418	423	433	435	472	379	431	511	467	445	393	413	374

Activity Concentration (dpm/100 square cm)

	A		B		C		D		E		F		G		H	
1	1035	1047	841	1100	1124	824	1124	1318	1482	1212	14018	1365	1171	1565	1606	1294
2	1041	1259	1118	1200	588	588	706	1224	706	1141	1324	2718	2459	2124	1882	1112
3	941		1059		765	588	659	1000	665	1094	1124	1335	1259	1382	1294	1159
4	1182		1000		1276	1547	1571	1453	1471	2547	1818	1600	1218	1276	1282	982
5	235		382		565	182	253	171	41	165	129	288	329	235	82	206
	782		706		982	700	641	835	529	135	894	1188	324	1400	1041	1441

	I		J		K		L		M		N		O		P	
1	1306	1388	1141	1124	771	2024	1753	1071	1124	1494	1118	1365	859	1100	1294	771
2	1229	847	1300	1224	1206	1782	1788	2659	2465	1541	1218	2276	1388	3476	4518	4206
3	1071	706	1124	1159	1329	1547	1276	2547	1365	2365	2418	1365	5153	1735	941	982
4	247		294		571	241	400	1029	588	788	600	894	859	1041	1006	1100
5	1788	1012	1547	424	1312	1371	1382	1600	1053	1359	1829	1571	394	1729	365	671
													1441	1135	1253	1024

	A		B		C		D		E		F		G		H	
1	1035	1047	841	1100	1124	824	1124	1318	1482	1212	14018	1365	1171	1565	1606	1294
2	1041	1259	1118	1200	588	588	706	1224	706	1141	1324	2718	2459	2124	1882	1112
3	941		1059		765	588	659	1000	665	1094	1124	1335	1259	1382	1294	1159
4	1182		1000		1276	1547	1571	1453	1471	2547	1818	1600	1218	1276	1282	982
5	235		382		565	182	253	171	41	165	129	288	329	235	82	206
	782		706		982	700	641	835	529	135	894	1188	324	1400	1041	1441

	I		J		K		L		M		N		O		P	
1	1306	1388	1141	1124	771	2024	1753	1071	1124	1494	1118	1365	859	1100	1294	771
2	1229	847	1300	1224	1206	1782	1788	2659	2465	1541	1218	2276	1388	3476	4518	4206
3	1071	706	1124	1159	1329	1547	1276	2547	1365	2365	2418	1365	5153	1735	941	982
4	247		294		571	241	400	1029	588	788	600	894	859	1041	1006	1100
5	1788	1012	1547	424	1312	1371	1382	1600	1053	1359	1829	1571	394	1729	365	671
													1441	1135	1253	1024

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-097 Large Probe
Location: Inside Non-DU Tunnel West Wall Ledge

Detection efficiency = 0.17 c/d
Background = 170 cpm

Instrument Response (CPM)

	A	B	C	D	E	F	G	H	I												
2		532		543	640		413		739		573	511	500	529	550	724	624	647	695	989	1006	1112

Instrument Response (CPM)

	J		K		L		M		N		O		P		Q		R					
2	961	899	1079	721	691	1268	2037	1280	1624	1373	1018	850	769	1460	1699	990	1126	1197	1426	1386	1110	991	1736	1514	1501	1382

Activity Concentration (dpm/100 square cm)

	A	B	C	D	E	F	G	H	I												
2		2129		2194	2765		1429		3347		2371	2006	1941	2112	2235	3259	2671	2806	3088	4818	4918	5541

Activity Concentration (dpm/100 square cm)

	J		K		L		M		N		O		P		Q		R					
2	4653	4288	5347	3241	3065	6459	10982	6529	8553	7076	4988	4000	3524	7588	8994	4824	5624	6041	7388	7035	5529	4829	9212	7906	7829	7129

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: CPI-S-054 Large Probe
Location: Non-DU Tunnel West Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)

	A		B		C		D		E		F		G		
1	446	350	383	354	396	365	368	439	503	445	478	454	482	475	472
	457		414		380		407		472		466		520		526
2	489	385	404	479	434	447	469	420	548	461	610	533	689	549	551
	649	523	523	564	600	593	555	647	440	503	618	425	446	465	497
	385		445		308		419		440		466		462		455
	428	345	399	386	360	407	360	434	454	532	486	486	497	464	462

Activity Concentration (dpm/100 square cm)

	A		B		C		D		E		F		G		
1	859	294	488	318	585	382	400	818	1194	853	1047	908	1071	1029	1012
	924		671		471		629		1012		988		1284		1329
2	1112	500	812	1053	788	865	994	706	1459	947	1824	1371	2288	1465	1478
	2053	1312	1312	1553	1785	1724	1500	2041	824	1194	1871	735	859	971	1159
	500		853		47		700		624		976		953		912
	753	265	406	388	353	629	353	788	906	1385	1094	968	1159	965	953

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Instrument Response (CPM)

	I	J	K		L		M		N		O		P		
1			420	381	493	584	658	453	444	400	417	395	411	419	485
			400	372	606		420		412		414		484		
2		354	396	453	403	570	522	401	509	663	652	527	632	648	
		352	395	422	439	386	485	407	451	446	474	400	455	429	483
		373	463	434	506	481	533	376							
			409	412	746	1425	414	439	405	421	419	394	426	379	

Activity Concentration (dpm/100 square cm)

	I	J	K		L		M		N		O		P		
1			708	478	1135	1671	2106	900	847	588	688	559	653	700	1088
			568	424	1800		706		659		671		1082		
2		318	595	900	606	1588	1306	594	1229	2135	3247	1335	1953	2047	
		308	559	718	818	506	1088	829	888	859	1024	588	912	758	1076
			959	786	1212	1124	1371	447							
			641	659	2624	6618	871	818	618	712	700	553	741	485	

RDEC Picatinny Arsenal
Survey Number: GPI-S-054 Large Probe
Location: Non-DU Tunnel West Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm 200

Note that background varied in the area monitored.

Instrument Response (CPM)

	A			B			C			D			E			F			G			H		
1	446	457	350	383	414	354	386	380	365	388	407	439	503	472	445	478	468	454	482	520	475	472	526	
2	489	385	385	404	445	479	434	308	447	469	419	420	548	440	461	610	466	533	689	482	549	551	455	534
3	649	385	523	523	445	564	600	308	593	555	419	647	440	440	503	618	466	425	446	482	465	497	455	408
4	428	239	345	369	445	368	360	220	407	380	241	434	454	243	532	486	220	468	497	225	464	462	228	448
	240		270	246		255	250		265	250		237	237		238	238		223	245		220	256		235
	238		255	238		250	240		242	225		250	243		237	230		226	235		224	449		536

Activity Concentration (dpm/100 square cm)

	A			B			C			D			E			F			G			H		
1	859	924	294	488	671	318	565	471	382	400	629	818	1194	1012	853	1047	988	906	1071	1294	1029	1012	1329	
2	1112	500	500	612	853	1053	788	47	885	994	700	708	1459	824	947	1824	976	1371	2288	953	1465	1478	912	1376
3	2053	500	1312	1312	853	1553	1765	47	1724	1500	700	2041	824	824	1194	1871	976	735	859	953	971	1159	912	635
4	753	229	265	406	118	388	353	118	629	353	241	788	906	253	1385	1094	118	888	1159	147	965	953	165	871
	235		412	271		324	294		382	294		218	218		224	212		135	265		118	329		206
	224		324	224		294	235		247	147		294	253		218	176		153	206		141	1485		1976

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Instrument Response (CPM)

	I			J			K			L			M			N			O			P		
1					420	351		493	584		658	453		444	400		417	395		411	419		485
					400		372			606			420			412			414			484		
2				354		396		463	403		570	522		401	509		663	852		527	632		648	
				352	395	422		439	388		485	407		451	446		474	400		455	429		483	
3				373			463			434			506			491			533			376		
					408		412	746			1425	414		439	405		421	419		394	426		379	
4	220	250	224	247		222	233		226	214		280	227		222	228		217	227		219	475	407	
				478	340			568			479			472			412			364			460	
	515		578			489	293		348	381		304	402		358	407		406	424		405	458		367

Activity Concentration (dpm/100 square cm)

	I			J			K			L			M			N			O			P		
1					700	476		1135	1671		2106	960		547	588		658	559		693	700		1088	
					588		424			1800			708			659			671			1082		
2				318		565		900	806		1588	1306		594	1229		2135	3247		1336	1953		2047	
				306	559	718		818	508		1088	629		588	859		1024	568		912	759		1078	
3							959			758			1212			1124			1371			447		
					641			659	2624		6618	671		518	618		712	700		593	741		465	
4	118	294	141	276		129	194	2165	153	82	1641	471	159	1600	129	165	1247	100	199	965	112	1618	1529	1218
				1835	824																			
	1853		2224			1700	547		859	1085		612	1188		928	1218		1212	1318		1206	1518		982

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Tunnel Inside 611B Top of Catch Box

Detection efficiency = 0.17 c/d
Background = 150 cpm

Instrument Response (cpm)

	A			B		
1	2106		2479	2421		2580
		2098			2513	
	2210		1839	2690		1816
2	1994		2223	1515		2026
		1924			1997	
	2151		2392	2376		2349

Activity (dpm/100 square cm)

	A			B		
1	11506		13700	13359		14294
		11459			13900	
	12118		9935	14941		9800
2	10847		12194	8029		11035
		10435			10865	
	11771		13188	13094		12935

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Catch Box East Wall

Detection efficiency = 0.17 c/d
Background = 200 cpm

Instrument Response (CPM)

	A			B		
1	232		250	185		220
		252			213	
	250		201	215		256
2	252		252	201		254
		234			210	
	241		255	221		223

Activity Concentration (dpm/100 square cm)

	A			B		
1	188		294	-88		118
		306			76	
	294		6	88		329
2	306		306	6		318
		200			59	
	241		324	124		135

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Catch Box West Wall

Detection efficiency = 0.17 c/d
Background = 200 cpm

Instrument Response (CPM)

	A		B	
1	268	226	213	236
	239		216	
	212	246	216	242
2	231	259	263	220
	266		225	
	233	264	236	244

Activity Concentration (dpm/100 square cm)

	A		B	
1	400	153	76	212
	229		94	
	71	271	94	247
2	182	347	371	118
	388		147	
	194	376	212	259

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Catch Box North Wall

Detection efficiency = 0.17 c/d
Background = 170 cpm

Instrument Response (CPM)

	A		B	
1	212	241	213	213
	212		225	
	208	187	165	246
2	213	252	214	221
	223		235	
	252	217	232	206

Activity Concentration (dpm/100 square cm)

	A		B	
1	247	418	253	253
	247		324	
	224	100	-29	447
2	253	482	259	300
	312		382	
	482	276	365	212

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Catch Box Ceiling

Detection efficiency = 0.17 d/d
Background = 200 cpm

Instrument Response (CPM)

	A		B	
1	248	272	271	235
	256		238	
	229	213	203	207
2	202	241	198	203
	240		220	
	269	236	287	230

Activity Concentration (dpm/100 square cm)

	A		B	
1	282	424	418	206
	329		224	
	171	76	18	41
2	12	241	-12	18
	235		118	
	406	212	512	176

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Catch Box Floor

Detection efficiency = 0.17 c/d
Background = 200 cpm

Instrument Response (CPM)

	A			B		
1	1038		740	1053		739
		795			830	
	1113		598	941		804
2	567		464	488		598
		516			543	
	947		202	459		677

Activity Concentration (dpm/100 square cm)

	A			B		
1	4929		3176	5018		3171
		3500			3706	
	5371		2341	4359		3553
2	2159		1553	1694		2341
		1859			2018	
	4394		12	1524		2806

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-049 Large Probe
Location: Non-DU Catch Box Step Face

Detection efficiency = 0.17 c/d
Background = 170 cpm

Instrument Response (CPM)

	A			B		
1	450		434	384		426
		437			421	
	403		437	416		407

Activity Concentration (dpm/100 square cm)

	A			B		
1	1647		1553	1259		1506
		1571			1476	
	1371		1571	1447		1394

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

APPENDIX E

ANALYSIS OF DATA FOR DU FIRING RANGE

ARDEC Picatinny Arsenal

Building 611B Characterization

DU Firing Range

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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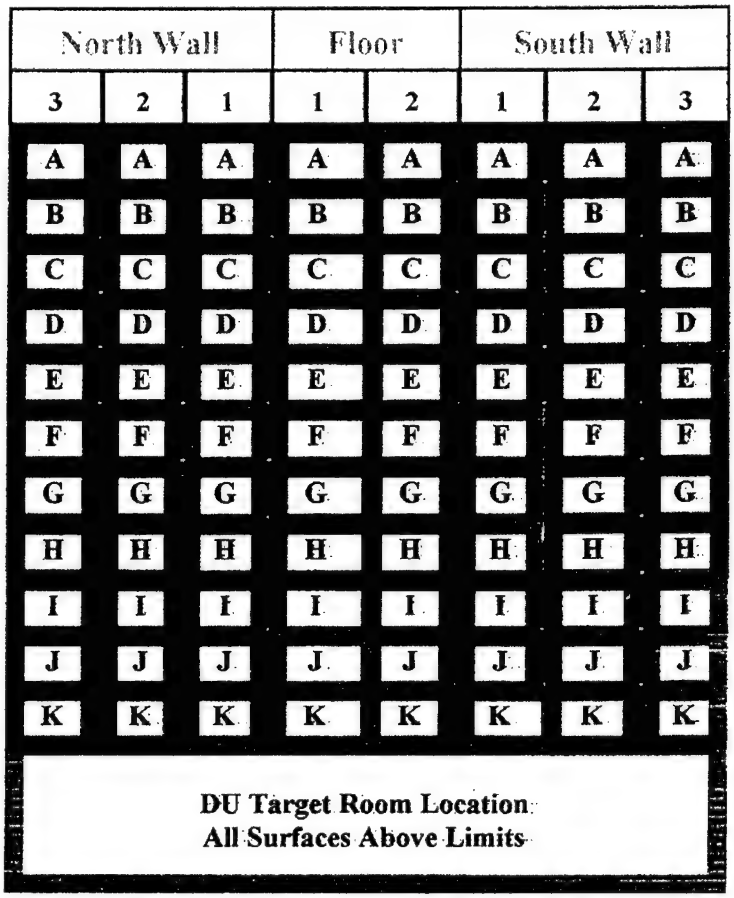
ARDEC - Picatinny Arsenal *DU Firing Tunnel Grid Layout*



= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Table DU-1

ARDEC Picatinny Arsenal
Survey Number: GPI-S-032 Large Probe
Location: DU Tunnel West End

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)

	A			B			C	
1	1005		1227	1956		748	1416	1403
			596		758			970
		1503	1498	3202		1212	906	722
2		1148	1101	1754		1557	1007	845
		1359			516		902	
		994	1618	2800		632	1221	1063

Activity Concentration (dpm/100 square cm)

	A			B			C	
1	4147		5453	9741		2635	6565	6488
			1741		2694			3941
		7076	7047	17071		5365	3565	2482
2		4988	4712	8553		7394	4159	3206
		6229			1271		3541	
		4082	7753	14706		1953	5418	4488

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-032 Large Probe
Location: DU Tunnel South Wall

Detection efficiency = 0.17 cpd
Background = 300 cpm

Instrument Response (CPM)

	A		B			C			D			E		
1	509		545	455		550	488		542	592		462	429	453
		804			765			685			632			
	936		1012	700		1079	901		1045	949		1042	552	606
2	279		287	261		293	354		374	343		353	325	309
		308			394			331			390			358
	276		321	349		400	368		408	385		339	333	373
3	315		327	326		341	392		357	361		345	323	426
		307			312			387			329			347
	323		311	287		312	371		342	453		471	293	307

Instrument Response (CPM)

	F		G			H			I			J			K	
1	304		397	427		451	550		1941	1206		1290	1166		723	551
		407			560			1424			1653			475		
	562		732	529		783	1004		2938	1379		2606	2246		612	830
2	279		316	283		298	254		319	386		423	893		927	
		277			327			347			392			882		1224
	292		313	279		293	254		347	487		715	654		723	853
3	392		356	363		412	407		390	528		633	1073		708	1125
		337			312			313			406			922		
	324		378	331		347	334		321	431		627	740		836	876

Activity Concentration (dpm/100 square cm)

	A		B			C			D			E		
1	1229		1441	912		1471	1106		1424	1718		953	759	900
		2965			2735			2265			1953			759
	3741		4188	2353		4582	3535		4382	3818		4365	1482	1812
2	-124		-76	-229		-41	318		435	253		312	147	53
		47			553			182			529			341
	-141		124	288		588	400		635	500		229	194	429
3	88		159	153		241	541		335	359		285	135	741
		41			71			512			171			276
	135		65	-76		71	418		247	900		1006	-41	41

Activity Concentration (dpm/100 square cm)

	F		G			H			I			J			K	
1	24		571	747		888	1471		9653	5329		5824	5094		2488	1476
		629			1529			6612			7959			1029		
	1541		2541	1347		2841	4141		15518	6347		13565	11447		1835	3118
2	-124		94	-100		-12	-271		112	506		724	3488		3688	
		-135			159			276			541			3424		5435
	-47		76	-124		-41	-271		276	1100		2441	2082		2488	3253
3	541		329	371		659	629		529	1341		1959	4547		2388	4853
		218			71			76			624			3659		
	141		447	182		276	200		124	771		1924	2588		3153	3388

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI-S-0 Large Probe
Location: North Wall DU Tunnel

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)

	A		B		C		D		E		F	
1	575	454	383	452	387	412	533	422	525	593	693	465
	617		654		788		786		683		1634	
	750	873	968	1059	1196	735	927	1344	1112	909	2631	1078
2	281	264	293	277	289	293	293	253	393	372	233	242
	286		294		272		287		341		272	
	274	245	294	286	323	306	323	315	353	382	330	305
3	247	281	264	287	315	386	415	393	440	424	384	397
	303		307		336		372		349		345	
	293	388	407	387	412	430	413	320	312	337	366	402

Activity Concentration (dpm/100 square cm)

	A		B		C		D		E		F	
1	1618	906	488	894	512	659	1371	718	1324	1724	2312	971
	1865		2082		2871		2859		2253		7847	
	2647	3371	3929	4465	5271	2559	3688	6141	4776	3582	13712	4576
2	-112	-212	-41	-135	-65	-41	-41	-276	547	424	-394	-341
	-82		-35		-165		-76		241		-165	
	-153	-324	-35	-82	135	35	135	88	312	482	176	29
3	-312	-112	-212	-76	88	506	676	547	824	729	494	571
	18		41		212		424		288		265	
	-41	518	629	512	659	765	665	118	71	218	388	600

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Instrument Response (CPM)

	G		H		I		J		K	
1	1137	956	1346	606	1629	814	841	1135		786
	3461		2211		2080		859			
	3448	2345	2904	3832	3499	3279	950	2623		810
2	345	268	328	374	532	376	861	782		912
	338		320		467		939			
	326	300	334	376	826	527	750	1029		1044
3	365	326	375	463	633	657	987	854		
	346		402		602		755			923
	343	306	366	337	601	508	650	825		674

Activity Concentration (dpm/100 square cm)

	G		H		I		J		K	
1	4924	3859	6153	1800	7818	3024	3182	4912		2859
	18594		11241		10471		3288			
	18518	12029	15318	20776	18818	17524	3824			3000
2	265	-188	165	435	1365	447	3300	2835		3600
	224		118		982		3759			
	153	0	200	447	3094	1335	2647	4288		4376
3	382	153	441	959	1959	2100	4041	3259		
	271		600		1776		2676			3665
	253	35	388	218	1771	1224	2059	3088		2200

ARDEC Picatinny Arsenal
Survey Number: GPI-S-033 Large Probe Detection efficiency = 0.17 c/d
Location: DU Tunnel Floor Background = 300 cpm

Instrument Response (CPM)

	A			B			C			D			E			F		
1	1103		909	862		888	1333		463	766		842	811		754	1555		977
			876		1340		3674	963	960	926		792	840		1218			
	674		1236	1103		964		1030			907			708		1291	708	934
2		984			1038			1050				973		1238			718	
			1125			1117			1121			1208						2547
		1355			1020			1876			1821			1268	1632			7209

Activity Concentration (dpm/100 square cm)

	A			B			C			D			E			F		
1	4724		3582	3306		3459	6076		959	2741		3188	3006		2671	7382		3982
			3388		6118		19847	3900	3882	3682		2894	3176		5400			
	2200		5506	4724		3906		4294			3571			2400		5829	2400	3729
2		4024			4341			4412				3959		5518			2459	
			4853			4806			4829			5341						13218
		6206			4235			9271			8947			5694	7835			40641

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Instrument Response (CPM)

	G			H			I			J			K					
1		1487			1346			1593		7352		3148	1342					
						2430			1241	4016	5180	7170	2105	9308	13292			
	1364		946	2351	2012		4325	2321				4457		3411	26490			
2			770		2428			3081			3462							
			2553		3880							3929						
		3650				1994		3090	3771			6320						

Activity Concentration (dpm/100 square cm)

	G			H			I			J			K					
1		6982			6153			7606		41482		16753	6129					
						12529			5535	21859	28706	40412	10618	52988	76424			
	6259		3800	12065	10071		23676	11888				24453		18300	154059			
2			2765		12518			16359			18600							
			13253		21059							21347						
		19706				9965		16412	20418			35412						

APPENDIX F

ANALYSIS OF DATA FOR DU TARGET ROOM

ARDEC Picatinny Arsenal

Building 611B Characterization

DU Target Room

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
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702-647-5699

ARDEC Picatinny Arsenal *Direct Activity*

Survey Number: GPI-S-059 Large Probe
Location: DU Target Room

Detection efficiency: 0.17 counts/disintegration

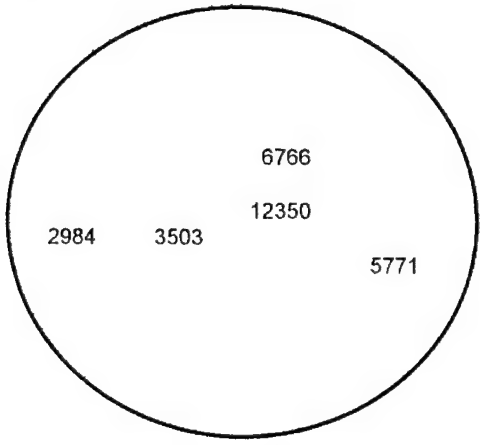
Instrument Response (CPM)

	1		2	
A	4387	5859	4266	
B	7239	10537	4092	
C	1414	1860	1392	2096
D	3186	7609	3044	2283
E	9964	6717	2860	3152
F	7273	5989	6167	
G	12100	3906	4341	
H	15086	22470	14239	8922
I	10754	8648	6482	
J	8178	7350	7597	6417
K	4075	4197	4450	4281

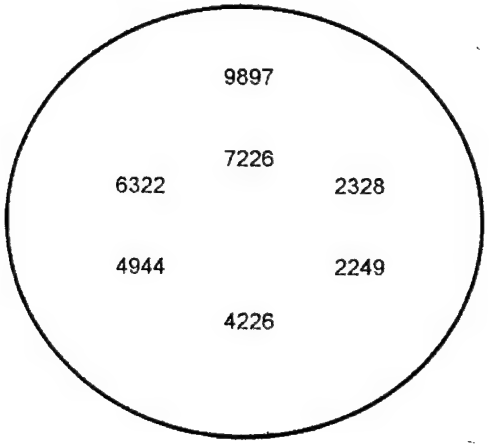
Activity Concentration (dpm/100 square cm)

	1		2		Average	Component
A	25806	34465	25094		28455	
B	42582	61982	24071		42878	
C	8318	10941	8188	12329	9149	Floor
D	18741	44759	17906	13429	27135	Table
E	58612	39512	16824	18541	38316	
F	42782	35229	36276		38096	
G	71176	22976	25535		39896	
H	88741	132176	83759	52482	101559	Vent
I	63259	50871	38129		50753	Light
J	48106	43235	44688	37747	45343	
K	23971	24688	26176	25182	24945	

Note: All locations exceed the 5000 dpm/100 square cm remediation level



Front wall - steel plate construction - cpm



Back wall - steel plate door - concrete wall - cpm

ARDEC Picatinny Arsenal *Loose Surface Activity*

Survey Number: GPI-S-059 Loose Surface Activity (Smears)
Location: DU Target Room Detection efficiency: 0.429 counts/disintegration

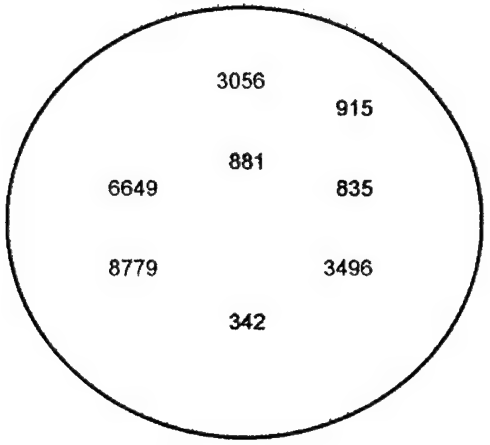
Instrument Response (CPM)

	1	Smear #	2	Smear #
A	13068	22	3520	21
B	1379.5	20	1331.5	19
C	94	37	35.5	38
D	63.5	36	64.5	35
E			401.5	33
F	242.5	34		
G	1658	32	1291.5	31
H	275.5	30	553.5	29
I	1169	28	5399	27
J	2086.5	26	6101	25
K	1645.5	24	2666.5	23

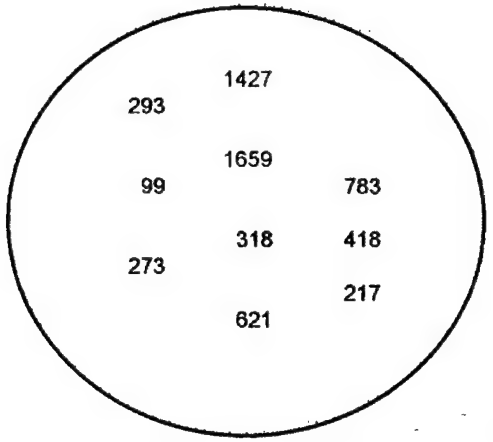
Activity Concentration (dpm/100 square cm)

	1	Smear #	2	Smear #	Average	Component
A	30462	22	8205	21	12896	
B	3216	20	3104	19	2113	
C	219	37	83	38	113	Floor
D	148	36	150	35	111	Table
E			936	33	936	
F	565	34			300	
G	3865	32	3010	31	2302	
H	642	30	1290	29	654	Vent
I	2725	28	12585	27	5113	Light
J	4864	26	14221	25	6370	
K	3836	24	6216	23	3358	

Note: All locations do not exceed the 1000 dpm/100 square cm remediation level



Front wall - steel plate construction



Back wall - steel plate door - concrete wall

APPENDIX G

ANALYSIS OF DATA FOR INSIDE STORAGE AREA

ARDEC Picatinny Arsenal

Building 611B Characterization

Inside Storage Room

Notes

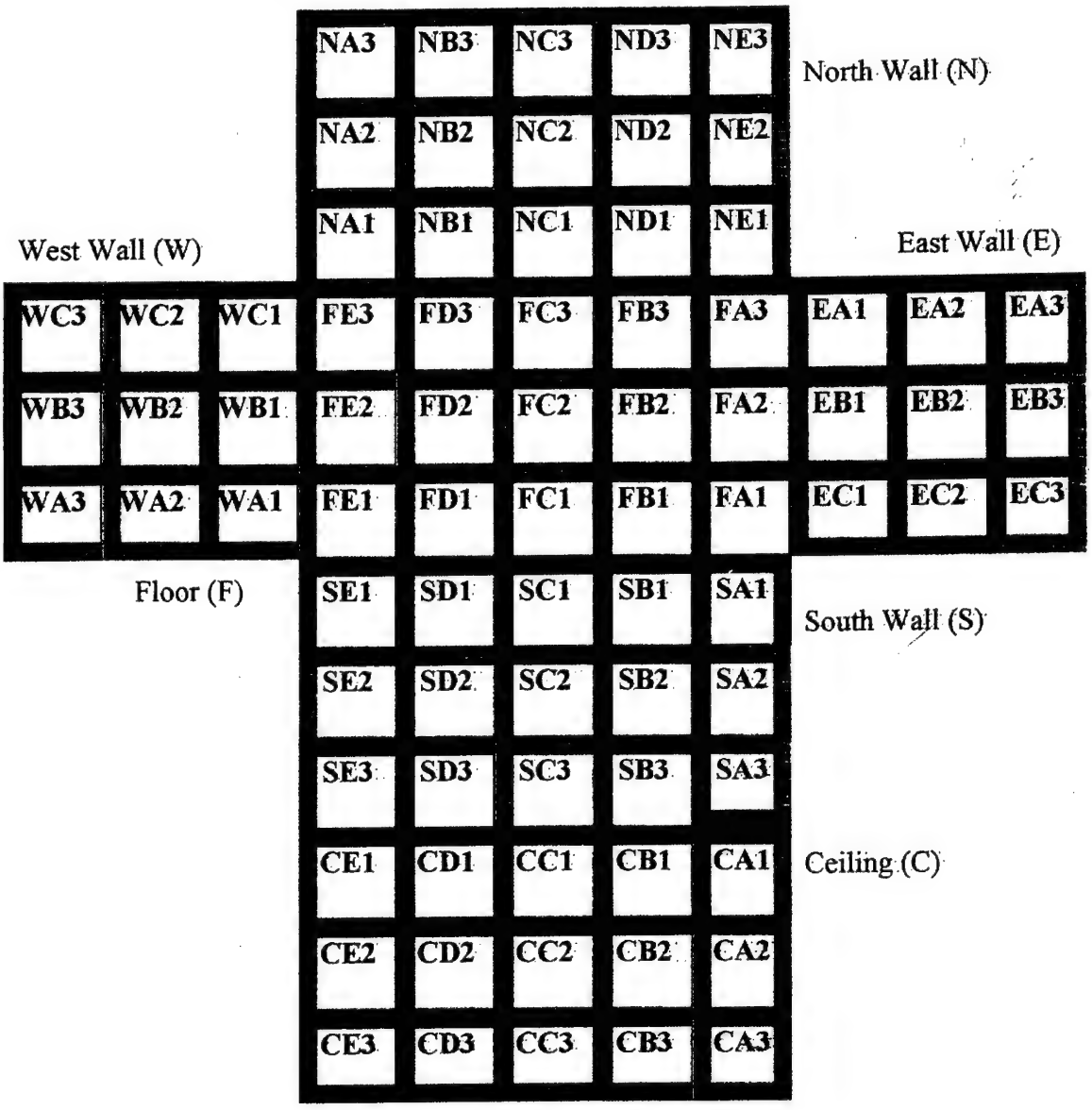
1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

ARDEC Picatinny Arsenal ***Storage Room Grid Layout***



= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Table SR-1

ARDEC Picatinny Arsenal
Survey Number: GPI -S-060 Large Probe
Location: Storage Room at the end of DU Tunnel Floor

Efficiency (c/d)= 0.17
Background (cpm)= 300

Instrument Response (CPM)

	A		B		C		D		E		
1	1823		2059	2112	695	1527	1121	1287	1414	1265	907
		1485		1045		1565		945		1116	
	828		669	1025	654	833	1016	977	678	455	468	395
2	563		911	451	636	595	537	594	503	432	382
		525		693		575		488		295	
	573		1358	462	486	479	459	452	399	297	340
3	647		1672	433	493	371	411	434	347	369	410
		669		478		396		338		341	
	600		1365	417	537	366	425	352	362	311	379

Activity Concentration (dpm/100 square cm)

	A		B		C		D		E		
1	8959		10347	10659	2324	7218	4829	5806	6553	5676	3571
		6971		4382		7441		3794		4800	
	3106		2171	4265	2082	3135	4212	3982	2224	912	976	559
2	1547		3594	888	1976	1735	1394	1729	1194	776	482
		1324		2312		1618		1106		-29	
	1606		6224	953	1094	1053	935	894	582	-18	235
3	2041		8071	782	1135	418	653	788	276	406	647
		2171		1047		565		224		241	
	1765		6265	688	1394	388	735	306	365	65	465

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI -S-060 Large Probe
Location: Storage Room at the end of DU Tunnel North

Efficiency (c/d)= 0.17
Background (cpm)= 150

Instrument Response (CPM)

	A		B			C			D			E		
1	151		163	159		182	245		237	318		427	445		783
		148			173			211			263			478	
	176		195	194		245	186		230	288		310	724		585
2	904		869	1019		1174	1356	1581	1870	2323		2210	2493		1916
		153			168			207			386			465	
	140		172	177		179	191		236	309		438	478		625
3	319		351	403	524	408	589	676	886	1187	1918	1508	2029		1539
		167			157			179			254			307	
	158		162	150		169	180		197	236		270	321		297

Activity Concentration (dpm/100 square cm)

	A		B			C			D			E		
1	6		76	53		188	559		512	988		1629	1735		3724
		-12			135			359			665			1929	
	153		265	259		559	212		471	812		941	3376		2559
2	4435		4229	5112		6024	7094	8418	10118	12782		12118	13782		10388
		18			106			335			1388			1853	
	-59		129	159		171	241		506	935		1694	1929		2794
3	994		1182	1488	2200	1518	2582	3094	4329	6100	10400	7988	11053		8171
		100			41			171			612			924	
	47		71	0		112	176		276	506		706	1006		865

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI -S-060 Large Probe
Location: Storage Room at the end of DU Tunnel South Wall

Efficiency (c/d)= 0.17
Background (cpm)= 150

	A		B		C		D		E		
1	217		170	153	154	139	130	146	153	142	130
		167		126		147		142		129	
	161		199	163	189	153	145	131	137	141	152
2	1396		977	1065	1045	915	726	690	721	637	587
		168		167		156		148		152	
	200		169	163	154	150	154	146	157	149	136
3	1267	1004	715	744	580	626	511	432	436	380	406	454
		186		183		162		156		147	
	193		207	150	201	154	161	147	151	144	138

	A		B		C		D		E		
1	394		118	18	24	-65	-118	-24	18	-47	-118
		100		-141		-18		-47		-124	
	65		288	76	229	18	-29	-112	-76	-53	12
2	7329		4865	5382	5265	4500	3388	3176	3359	2865	2571
		106		100		35		-12		12	
	294		112	76	24	0	24	-24	41	-6	-82
3	6571	5024	3324	3494	2529	2800	2124	1659	1682	1353	1506	1788
		212		194		71		35		-18	
	253		335	0	300	24	65	-18	6	-35	-71

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI -S-060 Large Probe
Location: Storage Room at the end of DU Tunnel East Wall

Efficiency (c/d)= 0.17
Background (cpm)= 150

Instrument Response (CPM)

	A			B			C		
1	529		497	336		699	451		284
		322			2717			252	
	709		284	355		243	229		188
2	1442		2015	1783		1769	1015		896
		345			677			230	
	455		773	418		274	389		258
3	252		407	437		327	307		150
		200			319			172	
	162		260	318			229		181

Activity Concentration (dpm/100 square cm)

	A			B			C		
1	2229		2041	1094		3229	1771		788
		1012			15100			600	
	3288		788	1206		547	465		224
2	7600		10971	9606		9524	5088		4388
		1147			3100			471	
	1794		3665	1576		729	1406		635
3	600		1512	1688		1041	924		0
		294			994			129	
	71		647	988			465		182

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

06

ARDEC Picatinny Arsenal
Survey Number: GPI -S-060 Large Probe
Location: Storage Room at the end of DU Tunnel West Wall

Efficiency (c/d)= 0.17
Background (cpm)= 150

Instrument Response (CPM)

	A			B			C		
1	146		137	107		181	174		166
		165			137			197	
	173		152	146		180	220		215
2	348		410	395		372	492		440
		474			559			168	
	174		126	168		162	173		158
3	151		147	141		154	146		149
		148			131			155	
	153		158	163		150	161		152

Activity Concentration (dpm/100 square cm)

	A			B			C		
1	-24		-76	-253		182	141		94
		88			-76			276	
	135		12	-24		176	412		382
2	1165		1529	1441		1306	2012		1706
		1906			2406			106	
	141		-141	106		71	135		47
3	6		-18	-53		24	-24		-6
		-12			-112			29	
	18		47	76		0	65		12

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPI -S-060 Large Probe
Location: Storage Room at the end of DU Tunnel Ceiling

Efficiency (c/d)= 0.17
Background (cpm)= 150

Instrument Response (CPM)

	A		B	C	D	E
1	175		241			
		316		180	182	184	161
	207		401			
2	440	620	704			
	203	245	420	197	176	176	180
	200		184			
3						
		186		179	157	142	142

Activity Concentration (dpm/100 square cm)

	A		B	C	D	E
1	147		535			
		976		176	188	200	65
	335		1476			
2	1706	2765	3259			
	312	559	1588	276	153	153	176
	294		200			
3						
		212		171	41	-47	-47

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Note: Due to the presence of the HEPA ventilation system on top of this room, the activity determination for the ceiling of this area is questionable. A revaluation should be made after removal of the HEPA system and decontamination of the roof area where the HEPA was.

APPENDIX H

HEPA VENTILATION SYSTEM SURVEY

Radiological Survey Report
Gutierrez-Palmenberg, Inc.
Routine Radiological Survey Form

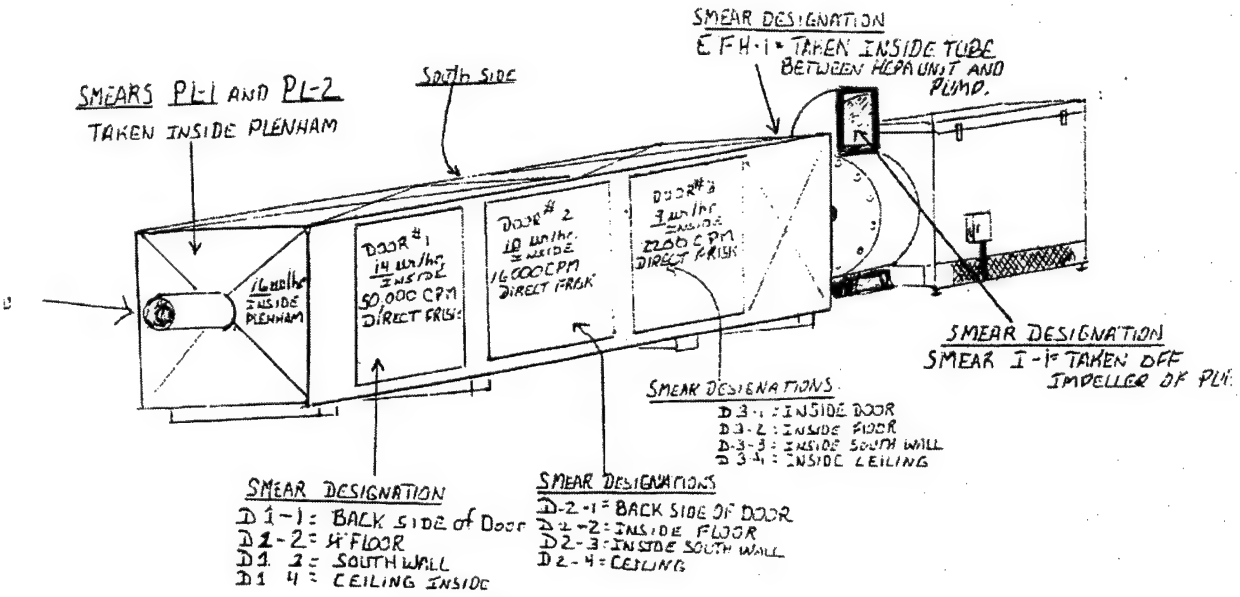
Facility: 611B

Survey Number: GPI-S-087

Date: 5 8 97 Time: 1300hr.	Instrumentation Used in Survey			
Surveyed by:	Model	Serial #	% Efficiency	Calibration Due Date
Location: HEPA VENTILATION SYS. ABOVE STORAGE ROOM Building 611B Picatinny ARDEC	LUDLUM 3	93101 PROBE 360	19%	9 18 - 97
	MODEL 19	109970	N/A	10-4-97
Review by:				

Smear location = (Number) Dose rate = uR/hour Frisk, count rate = cpm

Indicate North



Location or item description TOP OF STORAGE ROOM HEPA UNIT FOR DU TUNNEL

Notes Background for Ludlum 3 40-50 CPM BKG GRAND FOR MICRO R METER 6 uR/hr / ALL SMEARS WERE FIELD COUNTED ON LUDLUM 3, SEE ATTACHED FOR RESULTS.

Radiological Survey Report
Gutierrez-Palmenberg, Inc.

Facility: Pleasanton ARDEC 6113

Survey Number: GPI-S-087

Date: 5-8-97 Time: 1300	Instrumentation Used in Analysis					
Analyzed by:	Model	Serial #	Probe	Probe Serial#	%Efficiency	Cal Due Date
Bldg. 611B Hepa unit above storage Room	3	93101	44-9	360	10	9 18 97
	19	109970	NA	NA	NA	10-4-97
Review	NA	NA	NA	NA	NA	NA

Counting Results

Sample #	Count Time (min).	α Count	β Count	α CPM	β CPM	α DPM	β DPM
PL-1	NA				4600		46000
PL-2	NA				1000		10000
D1-1	NA				2600		26000
D1-2	NA				4700		47000
D1-3	NA				4700		47000
D1-4	NA				3400		34000
D2-1	NA		NA		1000	NA	10000
D2-2	NA				1600		16000
D2-3	NA				600		6000
D2-4	NA				1000		10000
D3-1	NA				240		2400
D3-2	NA				1600		16000
D3-3	NA				150		1500
B3-4	NA				140		1400

Counting Results Continued Survey Number GPI-S-087 Dated 5-8-97

Sample #	Count Time (min).	α Count	β Count	α CPM	β CPM	α DPM	β DPM
EFH 1	NA				120		1200
I 1	NA				120		1200
WA 1	NA				200		2000
WA 2	NA				100		1000

NA

APPENDIX I

ANALYSIS OF DATA FOR OPEN STORAGE AREA

ARDEC Picatinny Arsenal

Building 611B Characterization

Open Storage Area

Notes

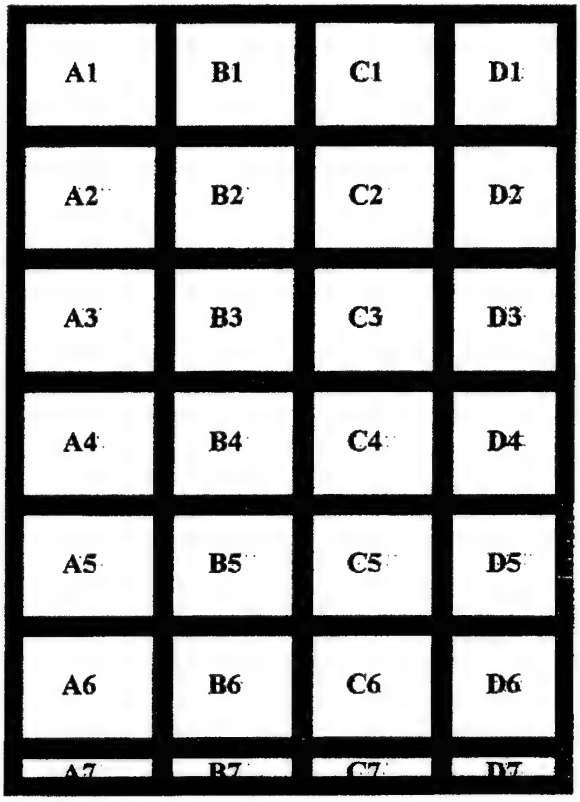
1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.

2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.

3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

ARDEC - Picatinny Arsenal *Outside Storage Area Grid Layout*



= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Table OS-1

ARDEC Picatinny Arsenal
Survey Number: GPI -S-029 Large Probe
Location: 611 B Gazebo

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)

	A			B			C			D		
1	464		461	437		385	518		459	338		272
		950			659			6802			661	
	433		485	698		739	747		781	407		467
2	436		376	515		295	438		653	475		371
		288			447			856			445	
	355		337	458		600	604		696	437		414
3	308		271	345		1034	367		526	433		599
		387			386			359			434	
	392		476	375		420	453		396	331		384
4	481		806	613		427	380		316	279		350
		520			393			472			405	
	598		480	422		403	478		439	384		416
5	444		435	351		368	498		542	747		780
		866			457			470			1018	1614
	769		485	405		1034	699		381	526		605
6	401		576	495		587	516		438	458		612
		1954			538			396			546	
	475		577	503		307	381		331	504		572
7		557			412			373		458		612
											546	
										504		572

Activity Concentration (dpm/100 square cm)

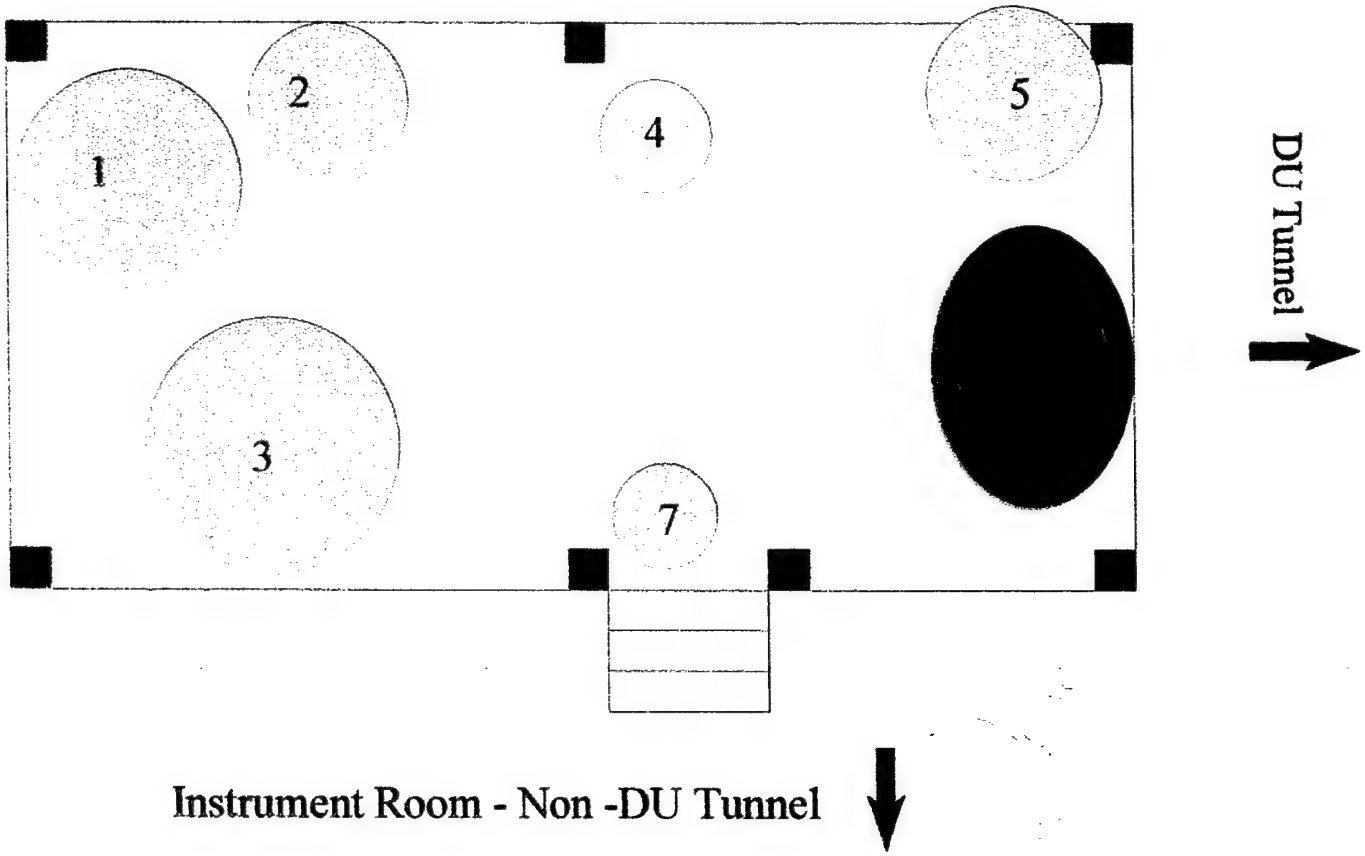
	A			B			C			D		
1	965		947	806		500	1282		935	224		-165
		3824			2112			37071			2124	
	782		1088	2341		2582	2629		2829	629		982
2	800		447	1265		-29	812		2076	1029		418
		-82			865			3271			853	
	324		218	929		1765	1788		2329	806		671
3	47		-171	265		4318	394		1329	782		1759
		512			506			347			788	
	541		1035	441		706	900		585	182		494
4	1065		2976	1841		747	471		94	-124		294
		1294			547			1012			618	
	1753		1059	718		606	1047		818	494		682
5	847		794	300		400	1165		1424	2629		2824
		3329			924			1000			4224	7729
	2759		971	618		4318	2347		478	1329		1794
6	594		1624	1147		1688	1271		812	929		1835
		9729			1400			565			1447	
	1029		1629	1194		41	476		182	1200		1600
7		1512			658			429		929		1835
											1447	
										1200		1600

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

Approximate locations of radioactive material found on the open storage area at ARDEC - Picatinny Arsenal, Building 611B



APPENDIX J

ANALYSIS OF DATA FOR BUILDING 611B GROUNDS

ARDEC Picatinny Arsenal

Building 611B Characterization

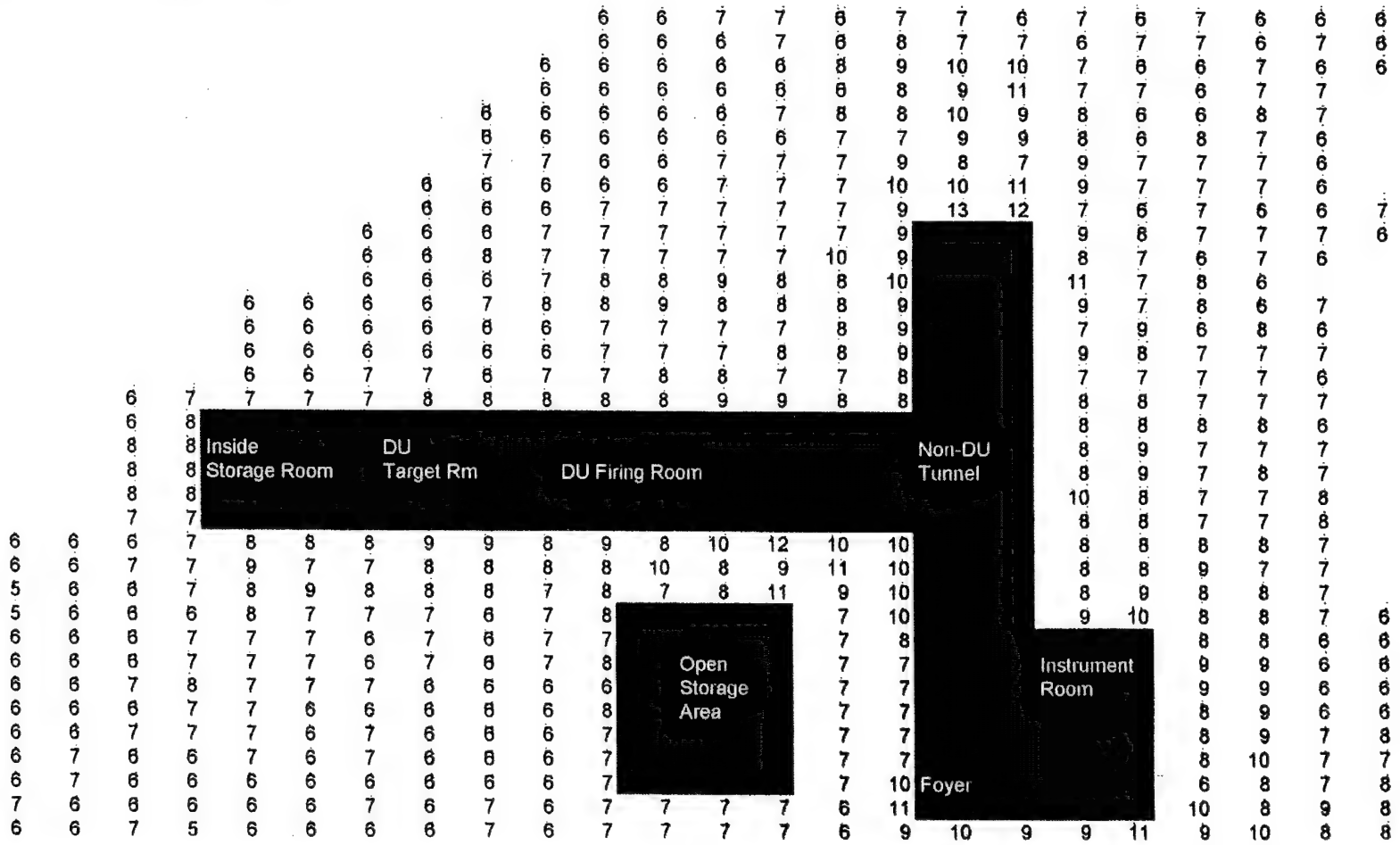
Grounds

Notes

1. Unexploded ordinance present in the area had no detectable activity.
2. Dose rates measured in the area around the building are consistent with background dose rates.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

ARDEC Picatinny Arsenal
Survey Number: GPI-S-088 Micro-R meter
Location: 811 B Outside Grounds



APPENDIX K

BUILDING 611B OPERATOR'S LOG

KL 6 VS. TRIPLE TARGET (.1" - .250" - .500") &
PROPELLANT IMR 4996 - 14' 20 MM SMOOTH BORE BBL.
9:1 PENETRATORS

RD #	CHg.	INST. VEL.	VEL.	PRESS.	X-RAY/TIME	X-RAY/VEL. T	TIME 4-5
1.	1080	686.6	4074	21.200	220.3	4105/4104.5	64.8
2.	1030	708.5	3948	16.500	239.0	3973/3971	64.6
3.	1055	688.5	4062	18.300	215.6	4034/4033	66.5
4.	1080	676.8	4133	20600	212.3	4142/4135	65.6
5.	1105	674.4	4147	21.400	211.1	4189/4188	66.0
6.	1120	660.9	4232	22.300	211.9	4227/4226	66.8
7.	1170	6451	4336	26500	189.7	4333/4329	746

65° USING 30 MM FAT ISEL CASES WITH 7" CHAMBER PRIMERS MS2 A3A6 ELECT. BASE LINE 33 9/16" = 2.799'

VEL. 4-5	TIME 6-7	VEL 6-7	TIME 8-9	VEL. 8-9	PENETRATION .1	.250	.500	REMARKS.
3931	84.1	3946	110.5		PR.1 C.	PR.1 C.	PR.3 C.	6-26-79
3944	82.9	[illegible]	NONE	NO PEN P.P.	P.R.2 C.	PR.2 C.	PR.4 P.S.B.	
4011	83.2		250.3	NO PEN P.P.	P.R.3 C.	PR.3 C.	PR.3 P.M.B	
4047	83.2	4090	250.4	NO PEN P.P	P.R.1 C.	PR.4 C.	PR.4 P.L.B.	6-27-79
4151	75.0	3873	244.7	NO PEN P.P.	PR.2 C.	PR.1 C.	PR.3 P.P.O.S	
4177	74.7	3996	244.8	NO PEN P.P.	P.R.1 C.	PR.2 C.	PR.4 P.L.B	
4269	67.0	3998	249.9		P.R.2 C.	PR.3 C.	PR.3 C.	6-28-79

BE6 VS. TRIPLE TARGET (.1" - .250" - .500")

PROPELLANT IMR.4996 - 14' 20 MM SMOOTH BORE BBL.

RD #	c Hg	INST. VEL.	VEL.	PRESS.	X-RAY TIME	X-RAY VEL.
26 - 7/10/79	965	856.0	3268	19.900	269.8	3288 / 3286
28	875	943.7	2964	12800	260.7	2987 / 2985
		Changed	to 20KV Charging Voltage (Diana)			
34	925	902.5	3099	15.500	NO TIME	NO X-RAY
~~MO~~	835	977.3	2862	12.300	297.8	2880 / 2878
16 7/12/79	735	1064.3	2627		300.8	2629 / 2631
18 7-20-79	790	10[illegible]	[illegible]	12400	286.5	2789 / 2786

BE5 GROUP B SAME AS ABOVE

BE5 30 1-23-79	710	[illegible]	[illegible]	[illegible] less than 4000	[illegible]	2555 / 2555
BE5 34 1-24-79	6[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2425 / 2426

D J

65° USING 30 MM FAT 15E1 CASES WITH 7" CHAMBER
PRIMERS M52B1 ELECT. BASE LINE 33 9/16" = 2.797'

TIME H-S	VEL. 4-S	TIME 6-7	VEL. 6-7	TIME 8-9	VEL. 8-9	PENETRATION .1"	.250"	.500"	REMARKS
						AVG. .102	AVG. .348	AVG. .515	PROJ. WT.
91.8	NO X-RAY	94.8	3074	249.6		PR#1 C.	PR#1 C.	PR#1 C.	1742 GR.
						RDS. #26+28 1/2" PLATE HI HARD			
94.2	2947	79.7	2415	252.3	NO PEN P.P.	PR#2 C.	PR#2 C.	PR#2 P.	PROJ WT 1744 gr
NO TIME	NO X-RAY	NO TIME	NO X-RAY	NO TIME	NO X-RAY	PR#3 C.	PR#3 C.	PR#1 C.	PROJ WT 1744 GR.
									PROJ WT
87.9	2830	117.9	2415	251.8		PR#4 C.	PR#4 C.	PR#2 C.	1738 GR.
						AVG. .174	AVG. .252		
						PR#1	PR#1	PR#3	PROJ. WT.
88.8	2577	117.7	2102	0.0		C	C	F.S.B	1741 GR
86.2		119.4		0.0		PR#3 C	PR#3 C	PR#4 C	WT. PROJ 1741
								AVG. 508	WT. PROJ
88.4	2500	[illegible]	2274	0.0		PR3 C	PR3 C	PR1 C	1741.
88.5	2354	118.0	2155	250.1		PR4 C	PR4 C	PR2 P	WT. PROJ 1745
								MB.	

BE4 GROUP "C" SAME AS ABOVE

Rd#	CHG	INST. VEL.	VEL	PRESS	X-RAY TIME	X-RAY VEL.	TIME 4-5
BE4 4 7-26-14	590	1283	2181	4002 3993	300.5	2160/2162	88.[illegible]
BE4 12 7-26-14	645	1[illegible]	2379	[illegible]	298.5	2303/2305	99.1
BE5-● GROUP "D" SAME AS ABOVE							
5 7-26-14	686	1113.7	2511	4005 3998	284.6	2530/2528	90.9
7 7-26-14	742	973.2	[illegible]	[illegible]	298.0	2616/2616	86.3
BE6 5 7-26-14	875	923.1	[illegible]	14,700	0.0		88.5
BE1 GROUP "E" SAME AS ABOVE							
1	690	[illegible]	[illegible]	[illegible]	[illegible]	2436 2438	97.5
Q1	1200	678.4	4123	31,700	—	—	—
Q2	1140	FALSE	—	24800	174.2		62.0

DU

VEL 4-5	TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION .1"	PENETRATION .25"	PENETRATION .500"	REMARKS
					AVG PR-1	AVG PR-1	PR3	WT PROJ 1006.5
2101	118.1	1839	[illegible]		C	C	P. 25	
2243	118.3		253.[illegible]		PR2 C	PR2 —	PR4 P. 25	WT. PROJ.?
2486	116.3	2115	250.3		PR3 C	PR3 C	PR1 P. 50	WT. PROJ 1732.5
2572	116.5	2311	253.5		PR-1 C	PR-1 C	P. 25	WT. PROJ 1732.
2931	117.[illegible]	2754	248.7		AVG PR-1 C	AVG 252 PR-1 C	PR3 C	WT -7.5 57
2341	118.0	2042	253.7		PR2 C	PR2 —	PR3 P. 25	WT. PROJ 1732
—	84.8		131.9		C.	C.	C.	WT. PROJ. 1007.5
	85.0		131.9		C.	C.	C.	WT. PROJ. 1006.5

STABALLOY VS TRIPLE TARGET (.1" - .250" - .500")
PROPELLANT IMR 4996 14' 20 MM SMOOTH BORE BBL.

RD#	Chg.	INST. VEL.	VEL.	PRESS.	X-RAY TIME	X-RAY VEL.	TIME. VEL. 4-5	4-5
260-00A-1	1140	697.5	4017	26600	197.7	1229.3/1226.3	62.0	1204.7
260-00A-2	1040	752.5	3724	20,700	231.3	1140.9/1139.9	94.0	LOST
260-00A3	975	598.2	4684	17.400	250.5	LOST	99.6	1060
260-00A4	975	803.4	3488	17,900	249.4	1080.0/1081.0	99.4	1051.5
260-0285	950	814.3	3441	15,700	248.7	1059.0/1059.0	89.9	1028.7
260-0286	900	859.2	3261	14,200	215.1	1005/1006	83.7	968.1

65° USING 30MM FAT 15E1 CASES WITH 7" CHAMBER
PRIMERS M52A3B1 ELECT. BASE LINE 33 5/8" = 2.802'

TIME. 6-7	VEL. 6-7	TIME. 8-9	VEL. 8-9	PENETRATION .1"	.250"	.500"	REMARKS.
							260-00A 63.75 .3007 X 3.000
84.8	870.1	132.2		C.	C.	C.	PROJ. WT. 982.8 GRNS.
89.8	LOST	132.2	?	C.	C.	C.	260-00A 63.8 gms. .3007 X 3.002 PROJ. WT. 983.0 GRNS.
96.1	995	135.8		C.	C.		PP. POS 260-00A 63.8 gms. L.B. .3008 X 3.000 PROJ. WT. 983.3 GRNS. PROJ. FRAGMENTS RECOVERED
97.6	946	135.4	210.9 *	C.	C.	C.	260-00A 63.8 gms. .3007 X 3.002 PROJ. WT. 984.0 GRNS.
85.6	916	132.3	581.6 *	C	C	C	260-02B 63.75 gms .3007 X 3.001 Proj Wt 984.0 GRNS
76.4	890.6	132.7		C	C	C	260-02B 63.8 gms. 3007 X 3.002 Proj Wt 984.0 GRNS

Lot	Chg	Inst Vel	Vel	Press	X-Ray Time	X-Ray Vel	Time 4-5	Vel 4-5
260-0287	850	906.9	3090	10,200	233.7	951.4/950.5	81.5	920.4
260-0ID-8	875			12300	243.4			
260-0ID-9	900	850.0	3296	13700	232.4	1009.9/1009.5	80.9	980.3
260-0ID-10	925	688.0	4072	14600	247.5		77.2	990.7
261-20A-11	950	811.2	3454	15000	242.1	1057.2/1056.9	79.9	1024.9
261-20A-12	935	818	3425	14400	237.0	1045.1/1045.1	80.4	1035

Time 6-7	Vel 6-7	Time 8-9	Vel 8-9	Penetration .1"	Penetration .250"	Penetration .500"	Remarks
76.2	855	133.0		C	C	P	260-02B 63.85 GMS .3007 X 3.002 Proj wt 984.0 gms
							260-01D 63.9 GMS
				C	C	MB	.3008 X 3.003 Proj wt 984.5 grms PROJ. FRAGMENTS RECOVERED.
73.6	891.7	133.1		C	C	MB	260-01D 63.85 GMS 3007 X 3.003 Proj wt. 984.2 gRMS
73.7	823	131.9		C	C	SB	260-01D 63.2 GMS .3005 X 3.001 Proj wt 981.5 gms
73.5	925.1	131.2	361.1 *	C	C	C	261-00A 63.7 gms .3007 X 3.000 Proj wt 982.0 grms
75.1	945	131.7	174.5 ? *	C	C	C	261-00A 63.7 gms .3007 X 3.001 Proj wt 982 grms

2.802

	Chg	INST VEL	VEL	PRESS	X-RAY TIME	X-RAY VEL	TIME 4-5	VEL 4-5
	920	844.1	3320	12800	237.5	1009.2	80.0	980.8
						↓ NEW K	10/31/79	
	910	838.0	3344	11900	233.0	1026.2/1027	79.7	995
	915	838.0	3344	?	233.3	1024.3/1027	87.7	1000
261-00 #16	950	953.1	2940	15700	224.8	1069/1070	79.9	1038
261-01 #17	975	791.2	3541	17200	227.2	1077/1080	88.3	1051
261-02 #18	1000	778.8	3598	17000	241.2	1110.3/1111.5	79.9	1080
261-02 #19	1100	710.2	3945	24100	238.6	1208.9/1211.3	79.1	1179
261-02 #20	1075	724.9	3866	22800	244.2	1185.5/1187.3	76.1	1163

TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION 1"	.250"	.500"	REMARKS
75.1	909	131.3	310.4	C	C	C	261-00A 63.7 Gms
			*				3006 X 3.000
				[illegible]	[illegible]	[illegible]	Proj wt 982.0
75.0	912	128.0		C	C	MB	261-01A 63.7 grm
							Proj wt 982.5 Grs
							10-31-79
75.3	898	128.6		C	C	C	261-01A 63.65 Grms.
							3007 X 3.0
							Proj. wt. 981.0
							10-31-79
74.2	947	No Reading		C	C	LB	261-00A 63.75 Gms
							3007 X 3.001
							Proj wt 980.5
							11-1-79
73.8	941	129.2		C	C	MB	261-01A 63.65 grms
							Projt wt 981.0
							11-1-79
73.5	964	?		C	C	MB	261-02C 63.7 grms
							3007 X 3.000
							Project wt 983.0 Gram
							11-6-79
43.6	1095	128.5	487	C	C	C	261-02C 63.7 gms
							.3007 x 3.002
							Pen WT 985.0
60.6	1054	128.5	389	C	C	C	261-02A 63.8 [illegible]
							.3008 x 3.001
							Penetrator wt [illegible]
							slight yaw No Pitch

2.802

RD	Chg	Inst. Vel	Vel	Press	X-RAY Time	X RAY Vel	Time 4-5	Vel 4-5
266 014A-21	1050	730.1	3838	21400	242.4	1174.4	72.7	1147
266 014A-22	1025	946.7	2960	12900	231.5	1038.8 / 1040.7	66.9	1007
266 021A-23 11-13-79	1000	759.7	3688	18000	232.8	1127.2 / 1126.5	-	
266 021A-24	950	768.7	3645	16800	233.4	1117.5 / 1118.5	73.7	1091
266 021A-25 11-10-79	950	833.1	3489	14900	231.5	1068.7 / 1069.2	68.6	1041
266 014A-26	925	839.4	3338	21400	238.1	1083 / 1025.8	65.8	
266 021B-27	975	795.0	3525	17000	233.6	1081.3 / 1081.8	65.7	1052
266 021B-28	1000	767.9	3649	18000	239.0	LOST HIT CABLE	66.6	1050
260-028 29	1000	771.0	3654	16,800	234.5	1118 / 1119	64.7	1099

Time 5-7	Vel 6-7	Time 8-9	Vel 8-9	Penetration .1	Penetration .250	Penetration .500	Remarks
1.2	1064	128.4	298	C	C	C	266-014A 63.8grams
							.3004 X 3.003
							Proj wt 983.0
1.4	912	129.2		C	C	SB	266-014A 63.5 grams
							.3000 X 3.002
							Proj wt 979.0
59.6	1019	128.0	527	C	C	C	266-021B-23 63.8grams
							.3007 X 3.001
							Proj WT 983.0
60.0	972	[illegible]	184	C	C	C	266-021A-24 63.85 gms
							.3007 X 3.003
							PROJ WT. 983.5
60.0	957	130.3	249	C	C	C	266-021A 25 63.6 gms
							.3004 X 3.001
							PROJ WT 981.0
59.3		128.6	—	C	C	MB	266-[illegible] 63.8 gms
							.3006 X 3.001
							PROJ WT 983.5
59.5	971	128.9	460	C	C	C	266-018 63.8 gms
							.3007 X 3.001
							PROJ WT 983.5
58.8	LOST	128.3	Lost				266-021B 63.85 gms
							.3008 X 3.001
							PROJ WT 984.0
58.8	992	108.3	547	C	C	C	266-02B 63.8 gms
							.3008 X 3.001
							Proj Wt 985.0 grams

Staballoy vs. Triple Target (.1"-.250"-.500")

2.802

RD	CHG	INST. VEL	VEL	PRESS	X-RAY TIME	X RAY VEL	TIME 4-5	Vel 4-5
260-01C 30	925	840.3	3335	12,500	233.1	1020.2 / 1020.2	66.0	994
61-02A 31	1000 GR	7704	3637	18,000	237.2	1118.9 / 1118.9	67.0	1087
261-01C 32	1135 GR	747.0	3751	16,200	236.4	1149.9 / 1149.7	72.0	1124

TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION .1	.250	.500	REMARKS
59.3	881	NO 107.5 Reading	266				261-01C 63.8 GM
							.300" X 3.000 =
							PROJ. WT. 980.0 GR.
58.5	1018	NO 107.5 READING	726				261-01C 63.8 GM
							.300" X 3.001
							PROJ. WT. 983.0 GR.
57.8	995	107.5	498				261-01C
							PROJ. WT. 980.5 GR

3/4 TI TRI ALLOY VS. TRIPPLE TST. (.1-.25-.500) 65° DEGREE
IMR4996 14" 20 MM SMOOTH BORE BBL. PRIMERS MS2A3B1 ELECT.

RD	CHG	INST. VEL	VEL	PRESS	X-RAY TIME	X-RAY VEL	TIME 4-5	VEL 4-5
#1 202-1	975GR	7[illegible]4	3563	11500	237.7	1098.1 / 1099	62.8	1063
#2 202-2	[illegible]	8[illegible]9	3490	15200	237.0	1069.7 / 1068	63.2	1043
#3 202-3	[illegible]	770.4	3637	18100	266.8	1112.2 / 1112.4	70.2	1083
#4 202-4	[illegible]	749.0	3741	19500	267.0	1143.1 / 1144.4	61.7	1116
#5 202-A-1	1050 gr	745.2	3760	20000	271.4	1154.0 / 1154.4	65.0	1127
#6 202A-2	1075	726.6	[illegible]	20[illegible]00	273.5	1181.1 / 1[illegible]97	62.3	1154
#7 202A-3	1100	712.5	3934	20[illegible]00	273.1	1196.2 / 1196.4	63.1	1172
#8 202A-4	112[illegible]	699.8	4014	20[illegible]00	276.2	1217.5 / 1218.7	63.6	1193

USEING 30MM FAT 15E1 CASES WITH 7" CHAMBER PROPELLENT

BASE LINE 33 5/8" = 2.802

TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION .1 .250 .500			REMARKS
56.8	971	108.8	LOW	C	C	C	12-12-79 202-1 63.1 GMS 10"
							L 3.000 X C.300 DIA
							976.5 GR
57.3	950	—		C	C	LB-CK	12-12-79 205-2 63.1 GMS
							L 3.002 X DIA 0.300
							980.3 GR
							LAST SCREEN BURNED
56.6	989	109.2	731	C	C	C	12-13-79 202-3 63.2 GMS 12"
							L 3.002 X DIA 0.300
							GR 977.5
57.1	1025	109.0	500	C	C	C	12-13-79 202-4 63.2 GMS 12"
							L 3.000 DIA 0.3000
							977.0 GR
57.7	1011	110.8	622	C	C	C	12-13-79 202A-1 63.2 GMS 10"
							L 3.002 X DIA 0.300
							977.3 GR
57.0	1074	109.9	807	C	C	C	202A-2 63.2 GMS
							L 3.003 X DIA 0.300
							977.0 GR
57.5	1105	110.2	787	C	C	C	202A-3 63.2 GMS
							976.0 GR
57.9	1117	998	881	C	C	C	202A-4 63.0 GMS
							975. GR

Staballoy PO-B483 14" 20 M/M smooth barrel

Rd #	IMR4996 Chrg.	Inst Vel	Vel	Press	XRAY Time	XRAY Vel	4+5 XRAY Time	4-5 Vel XRAY	6-7 XRAY Time	6-7 Vel XRAY	8-9 XRAY Time
					T.O.S.		1		2		3
6-2 2-27-80	800	948.7	2954	8800	304.8		117.6		123.4		518.2
6-3 2-28-80	880	889.1	3152	11600	268.9		106.6		113.1		414.4
6-4 2-29-80	880	874.1	3199	11000	282.1		117.6		84.4		413.6
6-5 2-29-80	960	771.2	3627	15300	298.2		110.2		85.1		415.5
A-8 3-7-80	900	840	3330	11700	286.4		116.8		87.4		413.7
A-9 3-10-80	890	853.3	3278	11100	288.2		118.4		85.2		409.4
A-10 3-10-80	900	848.8	3287	13300	289.9		111.5		85.3		410.8
A-11 3-10-80	915	834.6	3343	13300	288.0		110.5		85.2		410.7
A-12 3-11-80	915	833.9	3354	12600	[illegible]		107.1		85.6		411.8
A-13 3-11-80	925	827.5	3380	15300	[illegible]		110.1		85.6		411.7
A-14 3-11-80	940	826.7	3383	15900	286.7		110.9		86.0		414.8
A-15 3-12-80	955	823.9	3394	13000	292.5		102.9		85.1		410.1
A-16 3-12-80	920	847.2	3301	13200	288.8		108.7		85.0		410.3
A-17 3-12-80	960	816.2	3426	15400	292.3		109.6		84.5		411.2
A-18 3-17-80	920	801.9	3477	14600	294.1		110.7		85.1		411.7
A-19 3-17-80	900	870.9	3216	12400	284.7		109.5		85.6		411.3
A-20 3-19-80	900	854.0	3275	13300	288.3		118.8		86.0		416.6
A-21 3-19-80	915	849.3	3292	13400	283.9		109.9		86.5		416.9
A-22 3-19-80	885	871.6	3209	11900	286.3		110.4		86.9		416.9
A-23 3-20-80	965	796.4	3[illegible]	16500	292.7		117.2		85.0		[illegible]
A-24 3-20-80	885	2186.3		[illegible]	288.0		109.0		85.5		413.6
A-25 3-20-80	955	815.4	3430	14800	?		?		?		?
A-26 3-24-80	915	839.2	3333	13400	288.0		110.2		85.6		[illegible]
A-27 3-24-80	900	821.6	3454	9900	275.4		104.5		86.2		410.2
A-28 3-24-80	935	797.4	3520	11900	289.5		120.6		86.2		[illegible]

Angle Triple Plates Eng. Newark

Ray	Penetration Plate 1	2	3
	.1	.250	.500
	C	C	NS
	C	C	SB
	C	C	NO
	#6 C ↕	#100 C ↕	#29 C ↕
	#7 C ↕	#100 C ↕	29 C ↕
	#7 C ↕	#98 C ↕	#7 SB
	#8 C ↕	#98 C ↕	#7 SB ↕
	#8 C ↕	98 C ↕	#7 C ↕
	9 C ↔	97 C ↔	14 SB ↔
	9 C ↔	97 C ↔	14 MB ↔
	10 C ↔	97 C ↔	14 MB ↔
	11 C ↔	96 C ↔	36 C ↔
	12 C ↔	97 C ↔	14 MB ↔
	13 C ↔	97 C ↔	36 C ↔
	14 C ↔	96 C ↔	29 C ↔
	15 C ↔	93 C →	24 MB →
	16 C →	93 C →	36 MB →
	16 C ↑	96 C ↑	36 C ↑
	13 C ↑	95 C ↑	36 C ↑
	21 C ↑	100 C ↑	36 C ↑
	17 C →	100 C →	37 SB →
	18 C →	95 C →	32 C →
	19 C →	98 C →	19 LB →
	20 C →	98 C →	19 MB →
	22 C →	98 C →	19 C →

Remarks

DU Projectile wt 1006. grains
Penetrator wt. 1007 grains
Penetrator wt. 1008 grains
Penetrator wt. 1006 grains
Penetrator wt. 1005.2 "
Penetrator wt. 1004.2 "
Penetrator wt 1006.0 "
Penetrator wt 1006.0 "
Penetrator wt 1004.8 "
Penetrator wt 1007.2 "
" " 1007.0 "
Penetrator " 1007.5 "
Penetrator " 1005.5 "
Penetrator " 1006.0 "
Penetrator " 1006.0 "
Penetrator " 1005.3 "
Penetrator " 1006 "
Penetrator " 1005.7 "
Penetrator " 1005 "
Penetrator " 1006 "
Penetrator " 1006 "
Penetrator " 1006 "
Penetrator " 1006 "
Penetrator "

14' x 20" Y/M Barrel Smooth — FT PER SEC

Pwdr IMR 4996 tungsten RST Projectile versus Triple Target 65° Angle

Rd No	Grains Charg	Reading Fast / Slow	Vel	Press.	1 & 2 X-Ray Time	X-Ray Vel	4 & 5 X-Ray Time	4 & 5 Vel X-Ray	6 & 7 X-Ray Time	6 & 7 X-Ray Vel	8 & 9 X-Ray Time
#1 - M-2	1140	731	3648	17600	206.8	3651	31.1	3441	42.2	3034	None
#2 - M-3	1250	635	4200	32300	204.5	4195	37.2	/	43.	3582	108.9
#3 M-1	1275	623	4280	40600	220.0	4257	50.3	4065	23.0	3489	98.2
#4 M	1300	641	4160	30600	216.2	4142	40.6	3942	23.9	3415	98.6
#5 M	1350	621	4294	31200	212.2	Miss	43.3	Miss	34.3	3665	98.2
#6 G1	1325	625	4266	32900	212.2	4229	28.4	4004	39.7	3582	142.2
#7 G3	1350	622	4287	38600	212.4	4275	27.5	4043	40.3	3611	142.5
#8 M4	1350	612	4356	40400	295.6	4330	29.4	4128	57.7	Miss	140.9
#9 G2	1340	617	4322	39100	216.8	4300	29.2	Miss	47.7	3513	141.9
#10 - B1	1340	613	4349	35440	216.7	4318	29.1	Miss	39.1	3576	140.2
#11 - B2	1345	615	4335	37800	220.2	4304	28.4	Miss	48.6	3418	141.0
#12 - T5	1345	620	4306	35800	213.2		24.1		44.1		141.5
Series 7025											
#13 - V	1340	626	4259	33300	207.4	4266	23.5	4079	48.2	3735	139.7
#14 - X	1350	624	4274	31500	216.3	4269	23.6	4075	40.0	3672	140.6
#15 - 3	1350	624	4274	33100	215.8	4270	29.0	Cont 6E IDENTIFIED	45.8	Cont 5E IDENTIFIED	139.1
#16 - 4	1360	624	4274	36500	212.5	4260	29.2	4072	40.7	cont to identified	140.0
#17 - 5	1360	623	4280	39500	211.7	4285	29.5	4122	49.1	3623	140.2
#18 - 6	1365	617	4322	37400	216.1	4300	30.0	4073	48.6	3512	144.2
#19 - 7	1370	614	4343	35300	213.3	4316	29.8	4154	49.5	3363	144.4
#20 - 8	1345	623	4280	33600	213.1	4257	29.8	Lost	50.7	Lost	144.6
#21 - 9	1345	622	4287	36200	222.7	4269	30.4	4082	71.9	3749	147.8
#22 - 1	1350	622	4287	30200	221.0	4263	30.3	4129	59.3	3614	148.2
#23 - #2	1350	623	4280	32400	220.6	4273	Lost		60.1	3691	148.1
#24 - D	1350	614	4343	33000	204.1	4326	29.9	? Cont 5E IDENTIFIED	58.6	4159	148.9

30 M/M Fat 15E1 Cases

Eng. Dr. Cytron.

Primer M52A3B1 Elect

Base line 32" = 2.666

Penetration Plate 1	Plate 2	Plate 3	Grains Package + Projectile Weight	Date	Remarks	
C	C	SB	Proj. 1000 Pkg. Pack 1533.5	10-19-82	Series S7	7" Chamber
C	C	LB	Proj 999.3 Pack 1515.3	10-20-82		" "
C	C	LB	Proj-1000 Pack 1537.0	10-20-82		" "
C	C	VSB	Proj 1000.2 Pack 1536.2	10-20-82		8" Chamber
C	C	C	Proj 1001.0 Pack 1530.5	10-20-82		" "
C	C	MB	Proj 999.8 Pack. 1527.5	10-21-82		" "
C	C	C	Proj 999.3 Pack 1525.8	10-21-82		" "
C	C	C	Proj. 999.0 Pack 1527	11-22-82		" "
C	C	SB	Proj 1001 PKG 1530.5	11-22-82		" "
C	C	MB	Proj-1000 PKG-1530.2	11-23-82	Rd #6-B1 Target 300 the direction of arrow was Vertical Plate	" "
C	C	MB	Proj 999.5 PKG 1524.0	11-23-82		" "
C	C	SB	Proj 1000.5 PKG 1533.5	11-24-82		
						8" Chamber
C	C	MB	Proj-1002.1 PKG-1535.6	11-30-82		" "
C	C	SB	Proj 1002.1 PKG 1545.8	11-30-82		" "
C	C	SB	Proj 1001.1 PKG 1542.4	12-1-82		" "
C	C	LB	Proj-1000.8 PKG-1545.7	12-1-82		" "
C	C	MB	Proj-1002.0 PKG-1545.8	12-1-82		" "
C	C	MB	Proj 1001.0 PKG 1540.0	12-2-82		" "
C	C	LB	Proj 1002.0 PKG 1542.2	12-2-82		" "
C	C	MB	Proj. 1001.6 PKG. 1549.2	12-2-82	No Good	" "
C	C	MB	Proj. 1001.6 PKG 1545.1	12-3-82		" "
C	C	LB	Proj 999.0 PKG-1546.2	12-3-82		" "
C	C	C	Proj 1001.1 PKG 1538.4	12-6-82		" "
C	C	MB	Proj 963.0 PKG 1507.2			

Staballoy Barrel 14 ST x 20 m/m Smooth Vs Triple Target 65° Angle
Pwdr #4996 #1 .10 #2 [illegible]0 #3 .500

Reading Ill.

Rd. No.	Weight Charge	Reading 1st Vel	Vel.	Copper Pressure	Reading 1+2 X-RAY	1+2 Vel.	Reading 4+5 X-RAY	4+5 Vel.	Reading 6+7	6+7 Vel.	Reading [illegible]	8+9 Vel
164+#10	950	869	3219	12,000	285.0	3209	64.9	3101	92.9	5832	210.9	?
164+#11	1100	746	3780	18,100	285.5	3673	65.4	3531	96.2	8226	210.7	
[illegible]	1300	667	4193	30600	206.5	4189	49.5	4084	69.2	3845	195.2	
[illegible]#13	1200	709	3945	23100	225.2	3958	50.2	3829	69.2	3558	96.1	
[illegible]3#14	1225	699	4001	24900	226.3	4005	50.1	3873	57.5	3629	96.2	2753
[illegible]3#15	1200	708	3950	24900	226.0	3954	50.1	3838	57.0	3580	99.6	
[illegible]#16	1190	711	3934	23500	222.2	3927	50.7	3817	57.1	3417	82.6	
3-2#1	1000	834	3354	12900	267.7	3277	61.7	3274	71.2	2999	92.7	
3-2#2	1100	766	3651	18300	236.9	3693	58.8	3606	62.7	3253	84.7	
3-2#3	1100	755	3705	20200	237.1	3703	59.4	3572	63.7	3295	166.5	
3-6#4	1090	761	3675	21000	238.0	3665	59.0	3565	62.5	3182	342.0	263
3-6#5	1080	771	3628	20900	239.6	3651	59.0	3532	63.4	3266	339.4	
3-6#6	1085	761	3675	20900	239.9	3657	58.8	3559	62.9	3250	221.0	
3-6#7	1085	767	3647	18700	238.3	3700	58.7	3570	62.6	3014	208.2	
3-6-8	1090	760	3686	26400	239.4	3649	58.6	3575	58.2	3361	213.4	
[illegible]6-9	1095	179?	No Reading		231.1	No Picture	58.7	3577	57.4	3237	221.5	
188-2#21	1100	753	3714		No Reading	Miss	62.0	3610	57.2	3301	217.3	
188-2#22	1100	752	3719		229.3	3681	57.6	3571	56.5	3202	278.5	
188-2#23	1125	740	3780		242.5	3723	57.7	3591	59.2	3165	167.1	1823
188-7#24	1090	764	3661		245.2	3668	57.5	3554	59.2	Miss	166.8	
188-7#25	1080	763	3666		254.2	3623	57.7	3509	57.3	3207	165.2	
188-8#26	1085	768	3642		266.0	3651	57.6	3519	56.6	3177	165.2	
188-8#27	1095	775	3609		269.7	3663	57.6	3535	57.6	3171	166.0	
188-9#28	1110	757	3695	?	243.3	3745	57.0	3626	58.4	3319	168.[illegible]	
[illegible]-10-1#[illegible]	1100	769	3637		256.3	3706	58.6	Miss	59.9	Miss	156.3	2273

30 M/m Chamber Elect. Primer Base Line = 33 9/16 = 2.7969
30 M/m Fat Case M52A Eng. Kinas + Muldoon (Watertown, MA)

Penetration Plate #1	#2	#3	Projectile Weight + Package	Date	Shot No	Remarks
C	C	SB	Proj-976.5 Pkg-1550.1	12-13-82	1	
C	C	MB	Proj-955.7 Pkg-1524.5	12-14-82	2	
C	C	C	Proj-955.2 Pkg-1523.4	12-16-82	3	
C	C	L.B Crack	Proj-955.0 Pkg-1515.7	12-16-82	4	Large Bulge small crack
C	C	C	Proj 955.2 Pkg-1525.6	12-16-82	5	
C	C	C	Proj. 955.3 Pkg. 1530.4	12-16-82	6	
C	C	MB	Proj. 961.2 Pkg. 1535.8	12-17-82	7	
C	C	MB	Proj 958.7 Pkg 1631.2	12-20-82	#8	
C	C	C	Proj - 959 Pkg - 1535.5	12-21-82	#9	projectile just pass through. it was recovered right behind the plate.
C	C	C	Proj - 959.0 Pkg - 1533.9	12-21-82	#10	
C	C	C	Proj. 958.8 Pkg. 1530.2	12-22-82	#11	
C	C	L.B Crack	Proj. 960.3 Pkg. 1530.0	12-22-82	#12	crack appears in the Large bulge
C	C	MB	Proj 960.0 Pkg. 148.0	12-22-82	#13	
C	C	MB	Proj 962.0 Pkg. 1538.0	12-23-82	#14	penetrator is hooked up. bad flight oriented
C	C	LB	Proj 961.0 Pkg 1536.2	12-23-82	#15	
C	C	LB	Proj 961.0 Pkg. 1535.0	12-28-82	#16	Instant velocity wrong reading due to early break in screen.
C	C	C	Proj Pkg	12-29-82	#17	New Plates being used for
C	C	C	Proj : 958.0 Pkg : 1525.4	1-3-83	#18	Nario plate (Rockwell 41°c)
C	C	C	Proj : 958.7 Pkg : 1532.6	1-3-83	#19	
C	C	MB	Proj. 960 Pkg 1523.0	1-3-83	#20	
C	C	MB	Proj 960.0 Pkg 1531.7	1-4-83	#21	
C	C	MB	Proj. 960.0 Pkg 1514.5	1-4-83	#22	
C	C	MB	Proj. 960.5 Pkg 1553.5	1-4-83	#23	LONGER + HEAVIER SABOT
C	C	C	Proj Pkg 1551.9	1-5-83	#24	(?) [illegible] fragment
C	C	C	Proj 958.9 Pkg 1545.1	1-5-83	#25	

HABALLOY BARREL = 14ft x 20 MM - Smooth Triple Target = .1" .25" .5" plates 65° Inclined
POWDER #4996 R.U.

Rd NO.	WEIGHT CHARGE	Instr. READING	Instr. VEL	COPPER PRESSURE	TIMER READING 1-2	1-2 VEL	TIMER READING 4-5	4-5 VEL	TIMER READING 6-7	6-7 VEL	TIMER READING 8-9	8-9 VEL
18-1A	1125	754	3709	19700	240.3	3745	55.7	3642	59.2	Miss	153.8	
18-2A	1100	768	3642	26200	239.8	3688	55.3	3560	55.2	Miss	108.4	
-1A	1110	763	3666	19500	241.9	3703	54.7	3609	56.0	3349	91.7	1602
-2A	1105	755	3705	18500	240.8	3671	53.7	3577	44.4	3340	91.1	
-1A	1100	772	3623	18800	238.3	3652	53.4	3540	55.2	3293	207.6	
-A	1100	773	3618	18600	237.5	3638	53.5	3533	55.5	3271	56.0	
-1A	1100	792	3531	19700	239.0	3610	53.5	3497	67.3	3362	82.8	
-2A	1090	769	3637	20200	235.0	3635	53.4	3542	67.4	3389	105.4	
-3A	1085	780	3586	16900	240.0	3647	50.1	3526	59.7	3345	106.4	
-1A	1095	778	3595	15800	240.4	3628	50.2	3525	62.4	3334	106.7	
-2A	1090	779	3590	17200	240.8	3629	49.6	3487	61.8	3270	78.7	
-2A	1090	776	3604	20600	241.8	3639	50.3	3502	56.2	3224	77.9	
-3A	1095	778	3595	18100	237.3	3634	50.2	3564	64.2	3381	76.8	
-3A	1100	756	3700	19800	238.2	3667	50.0	3581	67.7	3417	77.1	
-1B	970	851	3287	13400	258.8	3280	50.0	3185	53.2	2937	78.5	
-2B	1010	823	3398	14500	259.7	3400	50.1	3273	53.9	3048	79.6	
-1B	1060	785	3563	17200	246.1	3534	50.2	3472	54.3	3251	79.7	
-2B	1090	776	3604	19700	225.9	3634	47.3	Miss	46.9	3403	79.8	
-1B	1060	791	3536	16800	221.1	3521	40.7	Miss	43.9	3162	79.3	
-2B	1090	779	3590	15800	226.4	3605	45.4	Miss	45.8	3051	79.7	
21-1B	1060	792	3531	15800	225.0	3533	45.8	3397	48.0	3288	77.0	
-1A-5	1100	754	3709	19800	225.60	3667	45.3	3557	51.9	3219	77.4	
-1-A	1100	770	3632	18800	222.1	3647	44.5	3459	38.1	CAN'T BE IDENTIFIED	78.1	
23-1-B	1100	778	3595	16500	225.1	3631	44.8	3548	41.7	3365	78.2	
[illegible]	1100	779	3590	19100	226.0	3635	44.8	3510	42.5	3308	77.4	
24-1-C	1100	776	3604	19600	226.1	3625	45.0	CAN'T BE IDENTIFIED	42.1	3515	77.3	
24-2C	1100	790	3540	17900	217.8	3590	41.7	3577	41.2	3313	42.1	
21-1C	1100	776	3604	12900	215.9	3622	35.8	CAN'T BE IDENTIFIED	35.7	3399	42.3	
[illegible]	1100	761	3673	23800	217.7	3645	32.1	3521	37.2	3465	42.9	
[illegible]	[illegible]	771	3628	[illegible]	220.9	3635	[illegible]	[illegible]	30.8	3505	44	

o m/m electric primer [illegible]   BASE line = 33 9/16 = 2.7969 ft.

30 m/m Fat Case [redacted]   MR. Greenspan

Penetration Plate 1	2	3	Projectile Package Weight	Date	Shot No	Remarks
C	C	C	Proj. 1031.0 Pkg 1621.5	1-6-83	1	1/50 pitch Rockwell [illegible] C (from Dr. Lytton) GROUP IA
C	C	MB	Proj. 1033.3 Pkg 1614.5	1-[illegible]-83	2	GROUP IA
C	C	C	Proj. 1033.5 Pkg 1606.5	1-7-83	3	GROUP IA
C	C	C	Proj. 1029.5 Pkg 1619.5	[illegible]	4	GROUP IA
C	C	C	Proj. 1018.7 Pkg 1606.2	1-11-83	5	Group II A
C	C	C	Proj 1021.0 Pkg 1606.9	1-11-83	6	Group III A
C	C	C	Proj 1031.3 Pkg 1632.0	1-11-83	7	GROUP IV A
C	C	LB	Proj 1022.0 Pkg 1614.4	1-11-83	8)	Group III A Large bulge with crack
C	C	MB	Proj. 1018.0 Pkg 1604.5	1-12-83	9	" III A
C	C	C	Proj 1032.0 Pkg 1618.0	1-12-83	10	" III A
C	C	SB	Proj 1014.7 Pkg 1590.9	1-12-83	11	" III A
C	C	SB	Proj 1032.0 Pkg 1619.7	1-12-83	12	" IV A VERY SMALL BULGE
C	C	C	Proj. 1031.0 Pkg 1616.0	1-13-83	13	" IV A
C	C	C	Prot 1028.0 Pkg 1611.2	1-13-83	14	" IA
C	C	SCR	Proj 1031.0 Pkg 1638.2	1-14-83	15	" IB just a tiny scratch
C	C	SCR	Prot 1030.0 Pkg 1632.0	1-14-83	16	" IB
C	C	MB	Proj 1020.0 Pkg 1615.2	1-14-83	#17	" II B
C	C	C	Proj. 1017.0 Pkg. 1624.2	1-14-83	#18	" II B
C	C	SB	Proj 1022.0 Pkg 1617.0	1-19-83	#19	" III B Very Small Bulge
C	C	SB	Proj. 1022.5 Pkg. 1605.6	1-19-83	#20	" III B " " "
C	C	SB	Proj 1026.5 Pkg 16[illegible]	1-19-83	#21	" IV B " " "
C	C	C	Proj 1026.5 Pkg 1608.9	1-19-83	#22	" IA
C	C	SCRATCH	Proj 1030.2 Pkg 1606.9	1-20-83	#23	} Greensburg special projectile
C	C	SB	Proj 1027.7 Pkg 1613.4	1-20-83	#24	}
C	C	SB	Proj 1005.2 Pkg 1590.7	1-20-83	#25	}
C	C	C	Proj 1033.3 Pkg 1651.6	1-20-83	#26	" II
C	C	SCRATCH	Prot 1031.5 Pkg 1644.5	1-21-83	#27	group II
C	C	C	Proj 1032.0 Pkg 1641.0	1-21-83	#28	group IV [illegible] Group I
C	C	MB	Proj 1032.0 Pkg [illegible]	1-21-83	[illegible]	

Stab alloy powder #4996 — Tungsten — BARREL: ~~14 ft~~ x 21 / 14 ft x 20 m.m — smooth — Triple target: .1", .25", .5" } plates 65° inclined

Rd No.	Weight charge	Instr. Reading	Instr. VEL	Copper pressure	Timer Reading 1-2	1-2 VEL	Timer Reading 4-5	4-5 VEL	Timer Reading 6-7	6-7 VEL	Timer Reading 8-9	8-9 VEL
				ALLOY		3059						
M	1350	652	4290	33100	200.1	4290	20.0	4126	52.8	3435	40.8	
3	1375	648	4316	34200	201.0	4335	26.9	4095	54.4	3395	40.9	
V	1450	623	4489	41200	199.3	4503	31.5	4289	44.8	3917	39.8	
4	1500	611	4578	43900	201.4	4594	31.5	4343	45.2	3802	39.6	
5	1600	584	4789	53000	192.8	4792	30.2	4580	38.9	4229	42.0	
6	1625	579	4831	56,200	190.8	4836	31.8	4622	38.3	4525	58.4	
7	1625	576	4856	56200	193.1	4838	30.1	4652	37.2	4392	42.0	
					ALLOY			3065				
V	1375	646	4330	35.000	192.4	4331	22.0	Can't be identified	52.3	Can't be identified	51.5	
1	1375	650	4303	35400	192.6	4308	21.7	3930	52.7	Can't be identified	51.9	
3	1325	667	4193	32,000	204.8	4219	miss	Miss	54.0	Can't be identified	52.7	
4	1600	586	4773	54400	189.1	4785	miss	Miss	32.2	Can't be identified	51.1	

Kind of charge: ST SHOT

1200 Gr — Lot 693-15-029 WEB
800 Gr — Lot RAD-E30-015 WEB
20 Gr — BLACK POWDER

#1	2020	567	4933	48500	187.1	4956	←

1260 GR LOT 693-15-029 WEB
820 " LOT RAD-E30-015 WEB
20 " BLACK POWDER

#2	2100	545	5132	58600	184.7	←

1240 GR LOT 693-15-029 WEB
860 " LOT RAD-E30-015 WEB
20 " BLACK POWDER

	2140	732		55200	192.0		←

w/m electric primer
w/m fat lace penetration

baseline = 2.7969 ft

Dr. Cytron #4245

DATE 1	2	3	projectile and package weight	Date	SHOT #	REMARKS
C	C	SPARK	PROJ: 997.5 PKG: 1542.5	1-26-83	#1	
C	C	SB	PROJ: 1002.2 PKG: 1542.3	1-26-83	#2	
C	C	MB	PROJ: 1002.2 PKG: 1549.7	1-27-83	#3	
C	C	MB	PROJ. 1002.2 PKG. 1548.2	1-27-83	#4	
C	C	LBWC	PROJ. 1001.2 PKG 1547.2	1-27-83	#5	Large bulge with crack.
C	C	C	PROJ 1002.5 PKG. 1541.4	1-27-83	#6	
C	C	C	PROJ 1002.0 PKG. 1537.7	1-28-83	#7	
C	C	CCR	PROJ 997.0 PKG 1531.7	1-28-83	#8	VERY slight scatter scratch. penetration disintegrate
C	C	SCR	PROJ 993.5 PKG 1533.9	1-28-83	#9	
C	C	CCR	PROJ 997.1 PKG 1547.7	1-28-83	#10	
C	C	SCR	PROJ 988.2 PKG 1561.9	1-31-83	#11	
←	→		PROJ. 1002.0 PKG. 1587.5	2-3-83	#1	
←	→		PROJ. 1002.5 PKG 1576.0	2-4-83	#2	
←	→		PROJ. 1002.5 PKG. 1554.9	2-4-83	#3	

TEST SHOT FOR VELOCITY

Wt charge.

#4 1250 Gr. Lot 693-15-029 WEB
850 " Lot RAD-E-30-015 WEB
.20 " black powder
Total: 2120

Instr. Time	Instr. Vel	Copper pressure	X-Ray Time	X-Ray Vel.	Date
538	5199	60,300	165.7	5119	2-28-83

#5A 1340 G Lot 693-15-029 WEB 3-1-83
820 G Lot RAD-E-30-015 WEB
20 G black powder

551	5076	52,000	164.6	5076	

#5B 1500 Gr. Lot 693-15-029 WEB 3-1-83
790 Gr. Lot RAD-E-30-015 WEB
20 Gr. black powder

559	5003		165.5	5019	

#5C 1200 Gr Lot 693-15-029 WEB 3-1-83
760 Gr. Lot RAD-E-30-015 WEB
20 Gr black powder

522	5358	66500	173.3		

TEST SHOT

INST TIME	INSTR VAL	COPPER PRESS	XRAY TIME	XRAY VAL
525	5327	66100	134.6	

Staballoy - D.U. BARREL = 18 ft x 20 M.M - Smooth Triple target .1" .25" .50" } plates 65° incl

POWDER # 4996

NO. #	WEIGHT CHARGE	Instr. READING	Instr. VELOCITY	COPPER PRESSURE	TIMER 1-2	1-2 VEL	TIMER 4-5	4-5 VEL	TIMER 6-7	6-7 VEL	TIME 8-9	8-9 VEL
#1	1050	Lost	Lost	14700	237.7	Lost	53.5	3190	50.5	3095	106.3	
#2	1010	860	3252	11300	243.4	3285	52.9	3190	50.5	2917	70.1	1920
#3	1025	851	3287	13700	245.7	3315	55.0	3199	48.6	2952	69.5	
#4	975	884	3164	12200	284.5	3208	58.5	3129	59.1	Lost	71.9	
#5	990	863	3241	13900	276.6	3234	53.7	3165	54.2	2954	72.1	
#6	980	880	3178	13000	270.2	3226	52.3	3121	46.8	2836	70.4	
#7	985	876	3193	12300	271.9	3244	49.5	3120	50.0	Lost	70.9	1421
#8	980	878	3186	12500	272.5	3232	49.3	Lost	51.1	2799	70.2	
#9	975	888	3150	11900	269.2	3195	49.0	3087	47.9	2780	68.7	
#10	978	862	3245	13200	269.9	3228	49.1	3121	50.4	2896	68.9	
#11	970	888	3186	12300	271.1	3203	49.0	3117	50.4	2751	69.2	
#12	970	Miss	Miss	13100	255.1	3198	48.0	3078	48.5	2926	70.7	
#13	975	Miss	Miss	12400	262.2	3210	48.3	3069	51.8	2852	71.5	
#14	1040	830	3370	13100	255.7	3396	56.7	3281	54.6	2883	72.1	
#15	985	866	3230	11800	254.9	3271	55.9	3163	53.9	2934	72.1	
#16	970	867	3226	13100	255.0	3199	55.9	3147	54.6	2527	72.2	
#17	990	859	3256	11400	228.8	3218	15.5	3186	35.8	2879	72.2	
#18	975	887	3153	16500	244.2	3157	26.2	3112	37.5	2963	70.9	
01-01 #1	970	875	3196	13600	248.2	3213	47.1	3081	51.8	2808	72.5	
01-01 #2	980	865	3233	9100	256.7	3254	51.4	3132	51.8	2847	72.9	
01-01 #3	990	856	3267	9100	256.0	3283	48.5	3171	49.9	2892	72.9	
01-01 #4	1010	848	3298	13000	249.0	3341	49.9	3230	53.7	3001	72.5	
01-01 #5	1025	Lost	Lost	13200	257.6	3393	51.1	3255	55.0	2849	71.1	
01-01 #6	1050	814	3436	16800	258.5	3462	52.2	3340	55.7	3098	71.2	
01-01 #7	1060	793	3527	17200	257.4	3500	52.3	3384	55.3	3144	71.6	2374
01-01 #8	1050	823	3398	2100	256.8	3435	52.1	3314	55.8	3095	71.6	
01-01 #9	1025	843	3318	12200	246.3	3383	51.4	3255	55.4	2998	73.1	
01-01 #10	1055	824	3394	15100	246.6	3438	53.4	3317	55.1	3077	73.1	
01-01 #11	1060	825	3390	12400	261.1	3460	53.3	3343	60.5	3061	82.1	
	1075	814	3436		245.1	3505	52.7	3399	75.0	3104	74.9	

30 m/m relative premium

30 m/m float loss

Annealing 2.7969'

Zebierski. (misfired metric system)

zebietsky

PENETRATION Date 1	2	3	PROJECTILE & PACKAGE wt	DATE	SHOT #	REMARK
C	C	C	988.0 / 1589.7	4 March 83	#1	
C	C	C	987.5 / 1579.2	4 March 83	#2	
C	C	C	987.3 / 1558.5	4 March 83	#3	
C	C	SB	988.0 / 1569.0	7 March 83	#4	
C	C	C	987.0 / 1579.0	7 March 83	#5	
C	C	MB	987.0 / 1580.5	8 March 83	#6	
C	C	C	987.0 / 1570.7	8 March 83	#7	
C	C	C	984 / 1572.9	8 March 83	#8	
C	C	SB	988.5 / 1576.4	9 March 83	#9	
C	C	C	988.0 / 1574.7	9 March 83	#10	
C	C	MB.	992.2 / 1579.4	9 March 83	#11	← FIRE
C	C	S.B	992.0 / 1566.5	25 March 83	#12	
C	C	S.B.	991.0 / 1576.0	25 MARCH 83	#13	
C	C	C	992.0 / 1573.5	28 March 83	#14	
C	C	LB	990.0 / 1561.5	28 March 83	#15	
C	C	SCRATCH	1013.0 / 1635.0	28 March 83	#16	
C	C	SB	1008.0 / 1617.2	28 March 83	#17	
C	C	C	1007.5 / 1692.5	29 March 83	#18	
C	C	SB	990.0 / 1574.0	6 Apr. 83	#19	
C	C	MB	993.5 / 1567.5	6 Apr 83	#20	
C	C	MB	992.7 / 1572.4	6 Apr 83	#21	
C	C	LB	993.0 / 1560.2	6 Apr 83	#22	
C	C	LB	988.0 / 1566.2	7 APR 83	#23	
C	C	LB w CRACK	993.7 / 1566.4	7 Apr 83	#24	
C	C	C	995.0 / 1574.2	7 APR 83	#25	
C	C	LB	995.5 / 1585.5	7 Apr 83	#26	
C	C	MB	995.0 / 1562.8	8 Apr, 83	#27	
C	C	MB	996.0 / 1582.7	8 Apr, 83	#28	
C	C	MB	[illegible] / 1575.7	[illegible] Apr, 83	#29	
C	C	C		[illegible] APR. 83	#30	

StabAlloy
powder # 4996

BARREL = 13 ft x 20 m.m - Smooth BARREL, Triple Tenget .1 .25 .50 } plates 65 yard

RD #	WT CHARGE	Instr. READING	Instr. VEL	COPPER Reading	TIMER 1-2	VEL 1-2	TIMER 4-5	VEL 4-5	TIMER 6-7	VEL 6-7	TIMER 8-9	VEL 8-9
#7	1340	685	4083	29300	198.6	4105	44.1	3989	35.9	Can't be identified	64.7	—
#8	1040	832	3362	—	260	3379	52.6	3259	77.5	3041	89.5	2036
#9	1040	Lost	—	—	[illegible]	[illegible]	52.2	3204	56.7	3109	89.9	—
#3	1350	684	4089	28000	200.3	4094	42.8	3962	53.9	3806	54.1	—
#4	1360	681	4101	33700	201.5	4126	40.2	4032	50.5	3858	54.3	—
#5	1200	747	3744	18900	210.9	3768	46.7	3629	50.7	3407	54.8	—
#2	1400	683	4095	31800	201.4	4108	40.6	3991	49.5	3748	54.0	—
#1	1420	660	4238	34000	199.2	4226	39.6	4133	51.0	3932	54.2	3394
#6	1100	807	3466	23500	[illegible]	3991	52.5	3388	53.1	3176	80.5	—

THE BELOW Testing shots ARE Tungsten Alloy.

30 m/m electric primer
30/mm [illegible] perforation

[illegible] : 2.74[illegible]', ∠R. Ahmed, [illegible])

PLATE 1	2	3	Projectile & package wt.	DATE	Shot # & REMARK
C	C	C	997.0 1592.5	6-6-83	#1 RESIDUE PROJECTILE WT. REQUEST.
C	C	C	1007.0 1631.0	6-6-83	#2
C	C	SB	1005.0 16[illegible]	6-6-83	#3 meter-[illegible] request
C	C	MB	1010.00 1631.2	6-8-83	#4 After 1st, disintg.
C	C	C	1001.0 1628.7	6-8-83	#5 proj. After 2nd, hit up >½ proj.
C	C	scratch	998.5 1631.0	6-8-83	#6 proj disintg. <½ proj.
C	C	C	[illegible] [illegible]	6-9-83	#7
C	C	C	1007.0 1630.7	6-9-83	#8
C	C	MB	1000.0 1642.7	6-9-83	#9

POWDER 4996 (Tungsten)

Rd #	wt charge	Instr. reading	Instr. vel	Copper pres.	Timer 1-2	1-2 vel	Timer 4-5	vel 4-5	Timer 6-7	vel 6-7	Timer 8-9	vel 8-9
43	1275	699	4001	26800	203	3975	40.0	3841	50.9	3528	86.6	—
44	1200	747	3744	20500	220.7	3780	49.2	3637	58.4	3400	87.0	—
27-1	1100	795	3518		320.2	3528	57.5	3429	Lost	Lost	69.6	—
7-2	1150	74	3614		229.7	3655	51.3	3488	57.1	3308	69.7	—
7-3	1175	752	3719		232.3	3734	49.9	3572	55.6	3289	70.3	—
7-4	1225	413	-0-		235.1	Lost	53.0	3722	55.6	3457	70.3	—

5MM. electric preheater
10-MM. Fat Gap

baseline - 27969 . Dr. AHMAD (MIKE)

plate. # 1	2	3	projectile. PACKAGE. wt	DATE	shot #	REMARK.
C	C	C	965 1538.5	7-25-83	#1	50.9
C	C	C	~~985~~ 1584.5	7-25-83	#2	
C	C	MB	991.0 1579.5	7-26-83	#3	
C	C	MB	1002.0 1598.0	7-26-83	#4	
C	C	MB	994.5 1554.0	7-26-83	#5	
C	C	BWC	998.0 1592.0	7-26-83	#6	

BARREL: 13 ft × 20 mm, - Smooth BARREL - Single Stage

wt charge

ARRAY

Rd #	6915019NEB	DADE-20015-WE	black powder	Instr. Ready	Instr Velocity	Copper pressure	Timer 1-2	Velocity 1-2	Timer 6-7
11	1340	820	20	567	5188	61200	163.2	5154	23.[illegible]
12	1330	800	20	592	4966	Lost	2084.4	[illegible]	196.8
13	1330	720	20	579	5077	52000	172.4	50[illegible]	2[illegible]
14	1330	750	20	Loss	—	48500	156.5	5005	[illegible]
15	1200	690	20	660	4455	31100	167.0	4435	211.7
16	1270	710	20	606	4836	23900	172.0	4804	218.5
17	1260	700	20	622	4727	39390	177.2	4727	219.2
18	1200	690	20	638	4608	30100	184.3	4589	169.2
19	1190	660	20	644	4565	21300	185.9	4542	168.0
20	1100	580	20	696	4210	23100	193.0	4216	167.5
21	1260	690	20	620	4726	36800	Loss	Loss	170.1
22	1330	750	20	591	4958	32600	161.0	4963	164.7
23	1330	780	20	Loss	Loss	31300	161.7	5038	165.5
24	1350	800	20	574	5105	24315	~~24315~~ —		166.3
25	1360	800	20	591	4958	59100	159.4	4909	167.2
26	1380	820	20	562	5214	55500	151.2	5206	167.6
27	1200	690	20	641	4571	53500	182.6	4577	130.2
28	1110	590	20	704	4162	21000	182.2	4168	151.3
29	1340	820	20	569	5149	53600	156.0	5148	149.0
30	1340	790	20	581	5043	51000	167.8	5038	147.6
DA #5	1340	780	20	583	5026	50800	141.4	5023	163.4
#6	1320	720	20	604	4851	21000	159.0	4836	143.1
#7	1340	740	20	597	4908		157.2	4908	144.2
31	1320	720	20	599	4891		166.5	4895	—
#32	1300	720	20	603	4859		162.2	4854	107.6
#33	1200	690	20	636	4607		171.0	4617	108.5
#34	1180	650	20	652	4494		171.9	4488	109.4
#35	1200	690	20	648	4522		176.0	4532	107.1
#36	1150	670	20	697	4201		179.0	4208	108.2

[illegible] 13 [illegible] 2811

1111

	[illegible]	Wt - Projectile	Package	Date	
[illegible]	C	1005	1578.0	[illegible]	1) [illegible]
		[illegible]	[illegible]	8-20-83	2) [illegible] fired. [illegible] blew out from barrel.
	C	1014.0	[illegible]	8-23-83	3)
	C	1004.0	[illegible]	[illegible]	4). ARMP. TARGET.
—	S.B	1005.0	1567.4	8-23-83	5). ARM.T. plate (2")
—	scratch	1003.5	1371.5	8-24-83	6) projectile went down ARM MT plate
—	C	1005.0	1570.5	8-24-83	7). ARAP TARGET.
707	C	1005.7	1570.2	8-24-83	8) " "
2783	C	1003	1577.7	8-25-83	9) " "
—	C	1004.0	1572.0	8-25-83	10) " "
—	N.B	1003.5	1576.0	8-25-83	11) " "
—	S.B	1003.7	1574.7	8-26-83	12) " "
—	M.B	1005.0	1580.0	8-26-83	13) " "
—	S.B.	1004.0	1569.7	8-26-83	14) Big IMPACT AREA on target
—	B	1004.0	1560.0	[illegible]	15) Case [illegible] blew off
	B	1004.0	1560.0	8-29-83	16)
2824	C	1004.0	[illegible]	8-30-83	17)
—	C	[illegible]	[illegible]	[illegible]	18) partial completion
	PC	1004.5	[illegible]	8-30-83	19) to just light through (consider ballistic limit)
624	C	1005.0	1569.5	8-31-83	20). 2"
1195	C	1005.5	1574.0	8-31-83	21) Du projectile ARM. plate.
—	S.B	1008.0	1571.0	9-1-83	22) " "
757	C	1007.5	1568.0	9-1-83	23) " "
—	N.B	1003.2	1565.4	11-28-83	24) Tungsten. ARM. PLATE
—	S.B			12-1-83	25) Ampl. 3 delay is 6.5 [illegible]
—	C			12-1-83	26) projectile didn't go through
2121	C			12-1-83	27) the cover plate.
—	C			12-2-83	28)
				12-2-83	29)

50. Caliber Long Rod. WyLuda Paul. WyLuda

Type Round	Test Reading	Inst. Vel.	pressure	X-Ray Time	X-Ray Vel.	Date
4	824	3556	40124	207.6		9-2-83
4-A	837	3501	37320	207.7		9-7-83
2	1001	2927	37600	205.5		9-2-83
2-A	877	3341	37440	258.7		9-2-83
3	830	3530	38360	252.6		9-6-83
3A	846	2463	42120	251.1		9-6-83
3	829	3534	35480	250.0		9-6-83
11B	808	3626	39320	249.7		9-6-83
5	1096	2673	49240	223.0		9-6-83
5A	1053	2783	47640	222.6		9-6-83
1B	775	3910	No Readings	—	—	9-9-83
2B	790	3709	57640	206.3		9-9-83
1X	1159	2528	49480	191.4		9-12-83
2X	1185	2473	28800	219.9		9-12-83
3X	1142	2566	52440	253.9		9-12-83
4X	1071	2736	54000	253.1		9-12-83
5X	1139	2528	54160	203.3		9-13-83
6X	1099	2666	21400			
P2	1585	1848	19280	190.3		10-17-83
P1	1352	2167	31360	206.4		10-18-83
P3	1768	1657	Loss	332.7		
P4	1966	1490	Loss	333.4		
P5	6427	456	21440			
P7	1766	1659	24140	161.4		10-19-83
P8	934	3137	28080	142.7		
P9	493	3909	30960			

53 Caliber
ERAY TIME

[illegible] line − 2.93

REMARKS.

Sabot fragment block thermal lifter's holes.

second back paper is not penetrated circuit blew off. scope power switch is off [illegible]

New baseline 23 1/8" (1927)

Stabballoy powder 4996 wt charge

BARREL = 13' X 20 M.M – Smooth BARREL single target

A.R.R.D.P

SHOT #	6931502 9 WEB	RAD-E30-015-WEB	black powder	Instr. READING	Instr. VEL	COPPER PRES.	TIME 1-2	velocity 1-2	TIMER 6-7
30	1360	740	20	585	5009	3022	161.9	5012	109.1
31	1200	690	20	639	4585		174.7	4588	109.5
32	1200	690	20	642	4567		172.2	4571	109.7
33	1340	790	20	577	5078		157.3	5101	102.2
34	1400	830	20	561	5223		157.0	—	102.7

M.M. electrical primer — baseline - 2,93'

M.M. jet tube Chamber Size - 10"

L 6-7.	penetration projectile package	Date	REMARK.
—	L.B.	12-2-83	#30 DU.
—	L.B.	12-7-83	#31 prefixed Vel. 4584
393	C	12-7-83	#32 ~~5038~~ 5106
—	MB	12-8-83	#33 ~~5038~~ disappeared
—	—	12-8-83	#34 projectile is ~~gone~~ in the plate

· stabilloy   BARREL 13 ft x 20 M.M. Smooth   triple target   .1" .25" .5" } pl… 6…

powder # 4996   greenspan, D.U.

Rd #	wt charge	Instr. Reading	Instr. Vel	Ch. pressure	Reading Timer 1-2	1-2 Vel	Reading 4-5	Vel 4-5	Reading 6-7	Vel 6-7	Reading 8-9	Ve 8-
759-6	1095	810	3284	12400	237.6	3323	—	—	—	—	—	—
769-1	1095	800	3325	11400	232.1	3355	53.7	3248	51.4	—	—	—
758-2	1130	788	3375	9760	218.8	3396	45.2	3283	55.7	3154	105.2	
766-6	1130	789	3371	12400	206.8	3406	35.9	3325	45.4	3241	81.1	26
760-7	1170	766	3473	14900	218.5	3513	14.0	3401	37.0	3254	81.8	21
758-1	1140	906	2936	9000	217.2	2960	27.7	2807	38.1	2696	82.8	—
766-7	1170	860	3093	9500	216.4	3145	38.9	3075	38.7	2959	86.2	—
768-5	1250	722	3684	18500	215.9	3712	39.1	3619	38.4	3549	83.3	
763-5	1185	755	3523	11200	215.7	3553	39.1	3435	39.2	3381	82.1	—
754-4	1185	763	3486	[illegible]	211.6	3519	33.1	3410	39.3	3288	65.1	9
757-7	1170	717	3710	[illegible]	212.0	3739	33.3	3692	39.1	3552	65.4	[illegible]
761-4	1160	773	3441	[illegible]	212.3	3468	31.3	3346	38.0	3287	61.4	14
759-4	1160	762	3491	[illegible]	211.6	3511	31.7	3455	39.0	3241	88.4	—
758-5	1160	762	3491	[illegible]	213.2	3517	30.8	3487	37.3	3277	86.8	—
765-8	1140	788	3395		211.5	3395	29.6	3349	40.9	3191	87.8	—
760-8	1150	772	3465		210.9	3467	29.9	3385	41.5	3230	89.1	—
758-4	1030	845	3166		210.7	3160	30.2	3060	35.5	2915	89.0	[illegible]
769-5	980	875	3057		210.3	3056	30.2	2967	42.8	2795	88.9	—
764-5	1000	862	3103		210.0	3105	30.3	3091	41.7	2713	90.1	—
760-3	1100	779	3434		209.6	3436	30.1	3314	42.9	31[illegible]	90.2	[illegible]

baseline 2.675

electric primer
flat case

penetration		projectile package wt	DATE	REMARK
C	SB	1020.5 1583.2	12-13-83 #1	L/D=20
C	SB	1018.5 1578.5	12-13-83 #2	L/D=15.5
C	C	1025.0 1642.0	12-14-83 #3	L/D=15 / >2500
C	C	1015.0 1590.0	12-14-83 #4	L/D=20
C	C	1023.5 1579.5	12-15-83 #5	L/D=15 / 3/4" third plate
C	NB	1017.0 1590.0	12-15-83 #6	L/D=20 vel is low relative to powder charge
C	SB	1022.0 1598.0	12-15-83 #7	L/D=20 change
C	C	1020.0 1599.2	12-15-83 #8	L/D=20. >3000
C	SB	1021.2 1598.2	12-15-83 #9	L/D=20
C	C	1022.0 1601.2	12-15-83 #10	L/D=20
C	C	1001.0 1581.0	12-15-83 #11	L/D=20 x
C	C	1021.0 1598.0	12-16-83 #12	" "
C	NB	1020.5 1622.7	12-16-83 #13	L/D=30 projectile BREAK apart
C	notch	1022.0 1610.0	12-17-83 #14	try pursue velocity 3400. L/D=25
C	SCR.	1023.5 1614.7	12-17-83 #15	1/2 third plate L/D=20
C	SCR.		12-17-83 #16	1/2 deep^ but small hole. L/D=20
C	C		12-17-83 #17	1/2" plate L/D=20
C	SC		12-17-83 #18	1/2" " L/D=20
C	SC		12-17-83 #19	1/2 plate. L/D=30. 2 IMPACT area in the third plate (1)
C	C		12-17-83 #20	1/2 plate
				1/2 "
				1/2 "

3406
3595
3323
3100
3145
3056
2966

Sintholog — Dr. Zichielsky — triple target

POWDER # 4996 — 20 M.M. x 11 ft.

.1" .25" Armor plate 65°

Rd #	Wt Charge	Instr. Reading	Instr. Velocity	Cu. Press.	Reading Timer 1-2	1-2 Vel	Reading 4-5	4-5 Vel	Reading 6-7	6-7 Vel	Reading 8-9	Vel 8-9
B1-6-3 #1	1070	809	3362	N.A. Too Low	228.8	3394	25.8	Loss	39.2	2798	92.6	
A1-7-1 #2	1080	813	3346		224.9	3349	26.3	3308	31.5	2975	91.2	Loss
A1-7-1 #3	1060	820	3317		228.3	3311	25.7	3166	31.0	2811	95.6	Loss
A1-7-1 #3	1040	827	3289		230.4	3290	0.80	3132	33.7	2867	78.5	Loss
A1-7-1 #4	1020	849	3204		239.8	3184	1.0	3045	36.1	2774	79.9	Loss
A1-7-1 #5	1000	854	3185		246.9	3184		Loss	35.2	2749	80.2	
B1-6-3 #2	1020	838	3246	9900	265.3	3260	49.8	3166	54.7	2886	171.9	538
B1-6-3 #3	1000	844	3223	8700	263.1	3223	51.2	3121	59.7	2768	151.7	1943
B1-6-3 #4	990	888	3060		282.0	3061	0		59.0	2659	153.5	
B1-6-3 #5	980	834	3261	8700	280.5	3155			(59.5)	2560	156.2	
A1-3 #1	1010	847	3211	9900	280.2	3187	51.0	3114	57.8	2767	155.3	
A1-3 #2	1050	812	3333	8700	280.2	3323	51.0	3216	59.4	2969	155.6	1555
A1-3 #3	1025	838	3246	8700	283.3	3228			55.5	2803	155.7	954
A1-3 #4	1015	833	3265		280.3	3224	56.8	3130	57.3	2823	155.6	
A1-3 #5	1020	820	3317		279.1	[illegible]	57.1	3141	57.1	2901	155.4	
B1-2-3 #1	1030	814	3342		278.7	3256	57.2	3160	58.8	2899	154.9	1530
B1-2-4 #2	1000	856	3178		286.8	3168	60.6	3067	55.1	2694	153.5	
B1-2-4 #3	1015	841	3234		281.6	3217	60.2	3141	56.3	2827	152.2	
B1-2-3 #1	1030	809	3362		279.9	3313	59.9	3219	51.9	2960	154.8	2166
B1-2-3 #2	1020	839	3242		280.2	3244	59.9	3144	51.5	2836	151.8	1627
B2-1-2 #1	1025	840	3238		288.0	3227	59.3	3138	52.7	2788	149.5	
B2-1-2 #2	1035	816	3333		284.1	3300	60.0	3196	51.7	2869	150.8	1689
B1-1-4 #1	[illegible]	823	3305		282.1	3294	60.0	3191	49.9	2892	151.0	
B1-1-4 #2	1030	811	3353		282.2	3269	59.9	3163	[illegible]	2893	151.1	
B1-1-3 #1	1033	808	3366		281.6	3285	59.9	3204	52.6	2932	151.2	1926
B1-2-? #6	1100	819	3321		240.3	3324	36.2	3226	47.7	2958	62.3	
B2-1-2 #3	1200	743	3661		238.8	3650	38.7	3526	37.0	3326	51.2	1210
B2-2-2	1150	759	3584		240.9	3584	38.3	3372	42.5	3227	65.3	1062
[illegible]	1100	803	3387		240.3	3372	38.6	3306	42.1	3045	65.3	37
[illegible]	[illegible]	799	3426		[illegible]	3342	38.5	3253	41.1	2960	65.9	

Baseline : ~~2675~~ 2.72'

penetration			projectile placement.	Date	REMARK.
	C	LB	1003.5 1367.0	8-21-84	#1 ½" SMOKE BOMB TEST accompany w/ TEST
	C	C	1005.0 1569.0	9-17-84	#2 ~~[illegible]~~ ½" plate.
	C	C	1005.0 1556.0	"	#3 ½"
	C	C	1006.5 1567.2	"	#4 ½"
	C	C	1008.2 1568.7	9-18-84	#5 ½"
	C	MB	1001.2 1567.2	9-18-84	#6 ½" New ½" plate.
	C	C	997.0 1558.0	9-26-84	#7 ½" "
	C	C	1005.0 1569.7	9-26-84	#8 ½" "
	C	MB	1008.0 1543.0	9-26-84	#9 ½" "
	C	LB	1006.0 1569.7	9-26-84	#10 ½" "
	C	MB	1005.0 1565.9	9-27-84	#11 "
	C	C	1006.0 1567.5	9-27-84	#12 "
	C	C	1005. 1575.7	9-27-84	#13 "
	C	MB	1005.2 1569.0	9-27-84	#14 "
	C	LB	1003.7 1559.9	9-27-84	#15 "
	C	C		9-28-84	#16 " B1-2-3 #1
	C	MB		9-28-84	#17 "
	C	MB		9-28-84	#18 "
	C	C		9-28-84	#19 B1-2-4 #1
	C	C		9-28-84	#20
	C	LB		9-28-84	#21 B2-1-2 #1
	C	C		9-28-84	#22
	C	LB		9-29-84	#23
	C	LB		9-30-84	#24
	C	C		9-30-84	#25
	C	MB		10-4-84	#26 ¾" ¾" dep on 3rd plate
	C	C		10-5-84	#27 "
	C	C		10-12-84	#28 "
	C	C		10-12-84	#29 pieces of ARMOR plate hanging inside the hole
	C	LB		10-12-84	#30 " A1-3 #6

Stahlhollow powder 4996
69315029WEB, RAD-E30-015-WEB

.1" 3/4
.25"

Rd#	Wt Charge	Crusher Instr. Press	Instr Vel.	Cu. Pres.	Timer 1-2	Vel 1-2	Timer 4-5	Vel 4-5	Timer 6-7	Vel 6-7	Timer 8-9	Vel 8-9
773-2	1150	764	3560	5	231.6	3532	18.8	3430	36.1	3286	74.6	13[illegible]
773-2#1	WEB 029 1340	541	5028	45300	152	4939	25	4912	17.4	4744	55.1	36[illegible]
	WEB 015 780											
773-2#2	1030	843	3226		223.9	3189	27.7	3102	30.3	284	385.4	
772-2#1	1340	660	4121	51300	159.2	/		/	25.2	/	55.2	/
	790											
~~776-2#2~~	~~1130~~	~~4121~~		13300								
772-2#2	1130	618	4401		247.3	LOSS	18.5	3424	35.1	3118	85.0	
776-2#1	1340	393	6921	46200	161.1	LOSS	8.8	4873	22.5	4725	70.2	422[illegible]
#1	790											
~~776-2#~~	1150	766	3550	14300	246.1	3524	19.1	3512	32.5	3412	83.8	
776-2#2												
777-2-#1	1350	632	4303	51200	156.6	/	14.0	/	24.3	/	54.0	/
	790											
777-2 #2	1350	547	4972	39600	163.0	4961	0 (16.)	Loss	23.4	4687	0 (56.5)	4436
	790											
773-2	1370	595	4571	[illegible]	150.2	/	15.3	/	23.7		/	/
	790											
776-2	1140	792	3434	16300	162.7	3380	15.08	3356	24.5	3026	56.5	/
774-2	1370	580	4690	53100	162.7	/	16.0	/	23.3	/	/	/
	790											
777-4	1150	758	3588	13700	246.6	3503	23.7	3452	36.8	3269	80.8	/
772-4	1155	760	3579	15300	247.5	3541	23.6	3493	37.5	3367	81.6	1040
772-4	1140	778	3496	12200	251.4	3454	23.9	3349	36.6	3204	85.9	
772-1	1145	767	3546	8700	252.0	3500	21.7	LOSS	45.3	Loss	84.3	1443
773-2	1350	678	4062	22500	211.9	3960	21.1	3852	22.4	3695	77.4	3112
772-4	1350	674	4035	21600	210.8	3977	18.4	Loss	23.2	3716	74.8	/
772-1	1180	742	3665	8700	244.6	3620	15.7	3519	39.4	3390	79.9	2515
774-4	1270	750	3627	190,000	242.7	3581	18.3	3561	35.3	3415	76.3	2628

.5°

JAY GREESPAN 2.72' = BASELine

Penetration			Projectile Package	Date	REMARK
C	C	C	1022.0 1593.2	9-18-84	#1 3/4" 1" Greenspan 15:1 D
C	C	C	1022.0 1596.0	9-18	#2 3/4" 15:1 D
			1025.0 1598.0		
C	C	NB		9-18	#3 3/4" 15:1 D
C	C	NB	1026.0 1614.5	9-19	#4 3/4" Penetrator Broke up
				20:1	" ALL X-RAY Missed A
			1021.0 1599.0		A
C	C	NB. SCRATCH		9-19	#5 20:1
C	C	C	1021.0 1605.5	9-19 S	#6 20:1 ✓ A
C	C	C	1022.5 1612.5	9-19 launch good	#7 penetrator Tumble, ✓ hit A the plate side way. 20:1
	C	NB	1617.5 1017.0	9-19	#8 ✓ ☆ 20:1 A
C	C	C	1025.0 1602.7	9-20	20:1 #9 Greenspan has all A the X-RAY from shot 1-9
C	NB	NB	1286.5 1880.0	9-20 B	30:1 #10 ✓ penetrator disintegrate, DU. fragment found inside the Test Range
C	C	MB	1291.0 1879.5	9-20	#11 30:1 ✓ B
C	C	NB	1287.0 1880.5	9-21	#12 penetrator shatter 30:1 ✓ B
C	C	LB with CRACK	1025.5 1612.5	9-21	#13 (20:1) A ✓
C	C	C	1616.5	9-21	#14 (20:1) A group ✓
C	C	MB	1285.0 1868.0	9-22	#15 (30:1) B group ✓
C	C	C	1025.0 1615.5	9-22	#16 (20:1) A ✓
C	C	C	1600.7	9-22	#17 A 20:1 ✓
C	C	MB	1021.0 1594.5	9-23	#18 15:1 D ✓
C	C	C	1025.0 1607.0	9-23	#19 30:1 B ✓
C	C	C	1367.0 1952.2	9-23	#20 30:1 BB ✓

stabilloy powder 4996

Rd #	wt CHARGE	Inst Reading	Inst VEL	C.U. Pressure	TIMER 1-2	VEL 1-2	TIMER 4-5	VEL 4-5	TIMER 6-7	VEL 6-7	TIMER 8-9	VEL 8-9
#1	1180	760	3579	11100	248.1	3552	24.6	3410	39.0	3144	86.3	
#2	1180			12200	241.1	3624	38.1	3522	39.8	3227	86.4	
#3	1300	680	4000	19000	231.7	3907	50.8	3812	40.3	3613	86.5	
#4	1400	656	4196	13000	218.1	4121	42.6	4021	37.9	3772	86.7	~~NA~~ 66
#5	1380	668	4072		210.0	4069	29.4	3941	29.2	3720	80.6	
#6	1395	664	4096		214.5	4080	340	Loss	35.3	3802	110.5	1406
#7	1385	666	4084									
#8	1380	668	4072		209.7	4061	~~32.7~~		32.1	3758	111.4	921
#9	1380	655	4153		209.1	40[illegible]	34.2	3977	34.0	3894	111.6	
#10	1385	657	4140		208.7	4066	34.1	4009	36.7	3802	111.9	2567
#11	1370	664	4096		206.3	4025	37.7	3951	31.3	3761	152.0	2384
#12	1250	713	3814		220.3	3766	35.0	3683	115.9 60.6	3202 ~~65.5~~	65.3	

Baseline 2.7a' JOE COX (AHMAD)

PENETRATION			projectile PACKAGE WT	DATE	REMARK projectile BREAKUP
C	C	NB	998.0 1542.9 997.3	9-24-84	U-Ti PURE DU. 10:1
C	C	SB	1520.4 995.7	9-24-84	U-Ti " " "
C	C	MB	1558.1 998.5	9-24-84	" " " "
C	C	C	1560.5	9-24-84	" " " "
C	C	LB		9-25-84	U-Ti/W10 10:1
C	C	C		9-25-84	" " "
C	C	C		9-25-84	#7 " " "
C	C	C		9-26-84	" " "
C	C	LB		9-26-84	(U-Ti/W10) 20:1
C	C	C		9-26-84	" " "
C	C	C		9-26-84	(U-Ti) 20:1 (PURE DU.)
C	C	C		[illegible]	" "

powder # 4996 Tungsten 13 ft x 20 MM. - Smooth

Rd #	wt charge	Instr reading	Instr. vel.	copper pressure	TIMER reading 1-2	1-2 velocity	TIMER 8-9	8-9 velocity
~~#1~~	~~[illegible]~~							
~~#2~~	~~[illegible]5~~							
#1	1565	678	4351	38400	209.6	4366	/	/
#2	1610	656	4497	39100	166.6	4490	/	/
#3	1600	652	4525	35600	168.8	4494	/	/
#4	1590	656	[illegible]	[illegible]	173.3	4497	/	/
#5	1575	664	4443	[illegible]	176.0	4450	/	/
#6	1575	684	4313	11300	175.2	4409	/	/
#7	1580	676	4364	[illegible]	175.9	4418	103.8	/
#8	1590	680	4338	37000	172.8	4484	104.2	/
#9	1585	737	4002	30600	193.7	/	/	/
#10	1565	667	4423	32800	194.5	4404	/	/
#11	1560	730	4041	/	194.1	4414	/	/
#12	1555	664	4443	31900	194.4	4423	/	/
#13	1550	661	4463	33500	193.3	4401	/	/
#14	1550	~~[illegible]~~ 673	~~[illegible]~~ 4383	32600	195.2	4357	/	/
#15	1550	671	4396	28800	188.8	4396	/	/
#16	1375 | 800	579	5095	54400	195.0	5110	/	/
#17	1375 | 800	577	5113	[illegible]	166.6	5078	/	/
#18	1375 | 800	575	5130	49800	168.6	5104	/	/
#19	1360 | 790	582	5069	48600	167.0	5029	/	/
#20	1320 | 750	605	4876		170.0	4866	/	/

baseline = 2.95 1 grain = 0.0648 gram

penetration	projectile wt & package wt (grains)	Date	REMARKS.
		~~10-10-85~~	
LB	65.318 / 102.932	10-10-85	#1 est. Vel: 4450. 3" plate (ARMOR)
C	65.355 / 102.687	"	" : " 3" plate (ARMOR) fiduciary Line on "T" has been adjusted.
LB	65.156 / 101.069	"	" " : " 3 1/2" " "
C	65.254 / 101.313	10-11-85	#4 3"
C	65.23 / 103.112	"	#5 3"
C	65.159 / 102.761	"	#6 Q-5-5 2"
C	64.764 / 102.382	"	#Q558 Last x-RAY film is exposed
SB [redacted]	65.308 / 101.363	"	#8 ~~Q5-58~~ Q5-59
C	65.126 / 101.988	10-15-85	Armour 1.8"
MB	65.68 / 103.191	10-15-85	ARMOR plate 1.8" (60°Δ) vel. Loss
MB	65.102 / 102.549	"	" 2" "
C	65.248 / 102.061	"	#12 Q561
[redacted] C	65.112 / 102.415	"	#13 Q562
SB	65.169 / 102.55	"	#14 Q563
[redacted] M.B	65.333 / 102.421 / 65.33	10-17-85	#15 1.8"
C	103.502	"	#16 2.15
C	65.184 / 102.643	"	#17 1" ARMOR (R.H.)
C	65.172	"	#18 Q560
SB	65.177	"	#19 Q564
LB w/crack	65.100 / 102.054	10-18-85	#20 2" RHA Vel. 4800 f/s.

Tungsten (40=133) Smooth BRL. 20 m.m. x 11' Single Target 60°

Rd #	029 WEB	015 WEB	BL. POWDER	Instr. READING	Inst. VELOCITY	PRESSURE (Psi)	TIMER
1	1350	770	20	581	5077	52,100	Loss
2	1330	750	20	591	4991	50,000	155.0
3	1320	750	20	609	4844	47,100	155.0
4	1280	700	20	625	4720	/	166.0
5	1270	700	20	652	4525	37400	169.1
6	1220	~~700~~ 660	20	645	4574		169
~~7~~	powder 4996			~~741~~	~~3981~~	~~37400~~	~~195~~
7	1435			741	3981	22500	195
8	1270	700	20	639	4617	39700	180.0
~~9~~	powder 4996						
9	1510			713	4137	28100	194
10	1430			751	3928	25400	214.1
11	1280			824	3580	18200	202.2
~~12~~							~~229.1~~
12	1200	660	20	/	/	33000	229.1
13	1530			725	4069	31600	188.1
14	1380			776	3802	23200	200
15	1275			848	3479	20,000	210.1
16	1200	650 ~~660~~	20	659	4476		183.0
~~17~~	~~#4996~~						
17	1520			689	4282		192.1
18	1320			759	3887		204.1
19	1100			876	3368		240.1

- ARAP Baseline = [redacted]2.95' Dick Snedeker.

Velocity (1/2)	Timer (7/8)	Velocity (7/8)	projectile wt grain	package wt	date	Remarks: Penetration
Loss	114.8	1350	1008.5	1576.2	6-24-86	RHA: 2" Complete
4953	114.5	1111	15"	1576.	6-24-86	RHA: 2" "
4928	118.3	N/A.	1009.3	1580.1	6-25-86	QS-65A (1st shot) "
4707	139.1	635	1019.5	1590.0	6-25-86	QS-65B (1st shot) "
4719	139.8		1007.5	1579.4	6-25-86	RHA 2" LB w/cork QS-65A (2nd shot)
4566	140.0	1560	1007.8	1578.9	6-25-86	QS-65A (2nd shot) "
~~4558~~	~~140.6~~				6-26-86	QS-65B (2nd shot) ND pen.
4128	142.6		1018.6	1588.6	~~6-26-86~~	~~QS-66A (1st shot)~~
4665	127.7	1905	1009.1	1580.2	6-26-86	QS-66A (1st shot) Comp.
			~~1009.1~~	~~1580.2~~		
4272	133.4		1007.4	1582.2	6-26-86	QS-66B (1st shot) L.B.
4136	131.4	1777	1009.2	1575.3	6-26-86	QS-66A (2nd shot) Comp
3816	125.3		1005.7	1563.7	6-27-86	QS-66B (2nd shot) N.B. Knock
~~4599~~	~~135.7~~		1002.7	1563.9		
4599	135.7	N/A.	1002.8	1567.3	6-27-86	QS-67A. (1st shot).
4331	131.5	N/A.	1009.4	1574.2	6-27-86	QS-67B (1st)
4071	131.9	1297	1009.3	1569.5	6-27-86	QS-67A (2nd)
					~~6-27-86~~	~~QS-67B (2nd shot)~~
3829	131.7		1009.3	1583.2	6-27-86	QS-67B (2nd) Knock
4479	135.6	1198			6-30-86	QS-68 (1st). C.
4309	133.2	N/A			6-30-86	QS-68 (2nd) C
3887	101.9	1529			6-30-86	QS-69 (1st) C
3405	96.7	N/A			6-30-86	QS-69 (2nd) C

Tungsten Smooth Barrel 20mm ... Single target = 63°

ARAP. 30mm. case ... electric primer

Rd#	.029 WEB	.015 WEB	Bl. Powder	Instr. Reading	Inst. Velocity	Pressure	Time
1 RHA	1320	750	20	636	4638	47700	179.[illegible]
~~2~~	~~1340~~	~~750~~					
2	1340	750	20	611	4828	45300	159.0
3	1380	760	20	608	4852	60600	159.[illegible]
4 (~~GP~~)	1370	760	20	590	5000	64700	158.[illegible]
GP1-5(5)	1440	770	20	605	4876	60,000	138.[illegible]
GP2-1(6)	1440	770	20	595	4958	57,300	115.[illegible]
GP3-1(7)	1480	7780	20	600	4917	56200	114.9
GP4-1(8)	1470	770	20	605	4876	—	115.0
GP1-1(9)	1340	750	20	636	4638	51200	117.1
GP2-2(10)	~~13~~ 1325	750	20	633	4660	—	127.2
GP3-2(11)	1220	700	20	473(?)	—	35800	130.0

Baseline 2.95'

Dick Snedeker

Velocity (1/2)	Timer 4/5	Velocity 7/8	Projectile wt. (grain)	Package wt.	Date	Penetration	Remarks
4935	40.1		1004.7	1602.9	7/7/88	LB	4905 L/D=15, Tungsten. 2" RHA. LB, 3 piece ½" Al plate (witness).
4944	40.1		1007.7	1605.2	7/8/88	LB/C	L/D=15 Tungst. 2" RHA. 3 piece ½" Al. plate
5000	40.1		1005.1	1598.7	7/8/88	S-B	L/D=15 Tungst. 2" RHA 3 pieces ½ Al plate (witness) penetrator is bent (deformed)
5003	40.2		1005.	1602.8	7/8/88	NB	L/D=15 Tungst. 2" RHA 3 pieces ½ Al plate witness very small bulge. penetrator in x-ray looks fine
4920	40.2		998.9	1909.3	7/8/88	~~SB~~ NB	~~[illegible]~~ fine Composite Rod (Tungsten center) graphite epoxy wrapped. witness plate Al 3 piece @ ½"
4950	40.2	N/A.	992.4	1853.20	7/8/88	C	penetrator went thru 3/witness plate and it the Concrete wall 45° 36"→ 36"
4763	50.1		978.0	1935.5	7/11/88	SB	penetrator base is broken. OD=0.278 ID=.185 (Tungsten)
4938	50.1		997.7	1926.7	7/11/88	NB	OD=.312 Tungsten .208 (SAME AS GPT) 4650
4702	50.2		1000.6	1921.3	7/11/88	NB	OD=.312 Tungsten .208
4669	50.1		992.9	1874.0	7/11/88	SB (very small)	OD=.360 Tungsten .200
LOSS	50.1		977.4	1923.5	7/12/88	C	4400 OD 0.278 ID=0.185 Tungsten went thru 1st Al witness plate and dent the 2nd one

SAME As last page

Rd#	029 WEB	015 WEB	H. powder PRESSURE	Inst. reading (us)	Inst. velocity (ft/s)	TIMER 1/2	velocity (1/2)	TIMER
GP4-2 (12)	1220	700	20	37100	679	4345	130.1	4309	50.0
Ref 35 Tungsten (alloy) (13)	~~1290~~ 1300	690	20	40400	618	4773	164.0	4709	50.2
Tungsten projectile shot#14	1370	760	20	51800	/	/	163.1	4973	50.0
GP1-2 shot#15	1260	720	20	37800	/	/	132.0	4419	40.1
GP2-3 shot#16	1250	710	20	33000	668	4416	132.1	4365 ~~4401~~	40.2
GP3-3 shit#17.	1270	725	20	41600	685	4307	132.0	4367	40.0
GP4-3 shot#18	1270	720	20	42900	657	4490	132.1	4474	40.2
GP1-3 shot#19	1300	730	20	48900	/	/	126.0	4545	40.0
~~GP3-4~~ GP4-4 shot#20	1200	705	20	32300	/	/	141.0	4286	40.2
Tungsten shot#21	1410	780	20	52900	608	4885	160.1	5087	40.

...ration Velocity	projectile wt.	Package wt	Date	penetration	Remarks
/	1000.2	1926.8	~~7/12/88~~ 7/12/88	LBw/Big crack	½ completed penetration
/	1004.2	1577.0	7/12/88	NB	A.R.Ap Target (ceramic) QS-70
/	1007.5	1576.6	7/14/88	NB	A.R.A.p Targ = QS-71, proposed vel>5000 ft/s
/	999.0	1918.2	7/14/88	NB.	A.R.Ap Target QS-72. penterator went downward and hit the bolt
N/A	993.4	1870.4	~~7/14/88~~ 7/14/88	C	A.R.A.p Target QS-73 make a little dent on 1st Al2 witness plate.
/	979.8	~~1861.2~~ 1941.2	7/14/88	SB	A.R.A.P. Target QS-74. penetrator BASE is deformed
/	996.8	1926.3	7/14/88	NB	A.R.A.p Target QS-75
/	1000.5	1934.7	7/18/88	~~SL Bulge~~ SLB	A.R.A.p Target QS-76 small local bulge due to penetration
/	977.0	1937.1	7/18/88	NB	A.R.A.P Target QS-77
/	1002.9	1574.2	7/18/88	CREASE	A.R.A.p Target QS-78

Triple target: 63° Base line: 2.72'

Rd #	D29	WEB 015	BL. PRESSURE	Cu PRESSURE	Instr. reading	Instr. Velocity	Reading 1/2	Velocity 1/2	Reading 4/5	Velocity 4/5	Reading 6/9	Velocity 6/9
Tungsten #24.	1385	765	20	48900			162.9	4948			23.0	456
Tungsten #25	1380	760	20	46500	544	5000	162.9		18.2		23.0	
Tungsten #26	1250	680	20	44100	590	4610	N/A	Loss	Loss	Loss	Loss	Loss
GP1-6 [illegible] #27	1340	760	20	54600	578	4706	176.0	4670 [illegible]	23.2		20.1	433
#28 GP2-5 (T5)	1300	700	20	42200	613	4433	223.0		20.0			
#29 Rd GP1 (T6) Tungsten	1340	700	20	42900	566	4806	171.0	4763	24.2	4697	30.0	427
#30 GP3-5 (T7) Tungsten	1329	715	20	39100	635	4283	162.0	4360	17.2		16.9	
#31 GP4-5 (T8)	1320	730	20	48300	602	4518	155.0	4526	14.1	4444	20.0 #7	
#32 GP2-6 (T9)	1315	720	20	45300	604	4503	155.0	4479	28.1	4413	28.0	427
#33 Gp1-4 (T10)	1300	720	20	47100	600	4533	154.8	4517	28.2	4414	27.9	412
#34 GP3-6 (T11)	1200	705	20	32300			153.1	4217	28.1			
#35 GP4-6 (T12)	1310	720	20	46200	608	4474	154.9	4516	26.1	4407	27.0	407

SAME As last page. A.R.A.P. (Al_3. fixture).

…ting 3/9	velocity 8/9	PENETRATION 1st pl. (.1)	2nd pl. (.25)	3rd pl. (.50)	projectile wt.	package wt.		REMARKS
—	N/A	C	C	C	1004.1	157~~[illegible]~~	[illegible]88	(T1) ~~penetrator~~ projector penetrate witness and the 5 ft wall and hit the Concret.
0.0	—	.1 C	.25 C	1" C	1003.3	1571.2	8/10/88	(T2) (Triple #2) ~~not~~ projectile pentrate all Target and make a dent 3/16" depth on the plate in front of the Concret wall.
oss	Loss	C	C	MB	~~998.8~~ 1005.1	~~1917.9~~ 1573.6	8/10/88	
0.0	—	C	C	NB	998.8	1917.9	8/10/88	projectile ~~is~~ is broken near middle after penetrate 2nd plate (1/4")
0.0	—	C	C	NB	993.3	1890.2	10/21/88	Triple Target, last ~~[illegible]~~ plate = 1" est. vel: ~~[illegible]~~ 4500 Ft/s., NO FILM.
0.0	1864	C	C	C	1002.4	1588.7	10/21/88	est. vel = 4800 F/s. Triple Target #6
0.0	—	C	C	NB	977.1	1943.1	10/21/88	est vel: 4300 F/s. Triple Target #7. ant scratch on Impact side, back plate
0.0	1144	C	C	C	1000.3	1925.0	10/21/88	Est. vel: ~~4~~550 F/s. Triple Target #T8
0.0	~~[illegible]~~	C	C	N/B	999.8	1882.4	10/21/88	Est vel: 4550 F/s A scratch on ~~thick~~ third plate.
0.0	—	C	C	NB	1000.6	1947.6	10/22/88	est. vel: ~~4~~450 F/s. scratch.
0.1	—	C	C	N/B	979.1	1903.3	10/26/88	est vel: 4300 F/s. (Scratch). Penetrator Break
0.1	—	C	C	N/B	1002.3	1891.9	10/26/88	est. vel: 4500 F/s

baseline 2.72'

Rd #	WEB 029	WEB 015	Bl. Powder	Cu Pressure	Instr. Reading	Instr. Velocity	Reading 1/2	velocity 1/2	Reading 4/5	velocity 4/5	Reading 6/7	Velocity 6/7
Shot #58												
REF E-2-5	1430	775	20	52000	465?	N/A	136.0	5021	32.1	4908	29.9	4806
Shot #59												
REF E-2-6	1360	745	20	41000	583	4666	168.0	4757	27.1	4610	29.9	4481
Shot #60		770										
REF EP2-6	1350	~~760~~	20	50000	568	4789	157.9	4751	35.9	4652	35.0	4451
Shot #61												
EP2-7	1310	~~735~~	20	43500	584	4658	154.1	4608	28.1	4480	30.0	4392
		May 2nd 89.		Triple	Target							
Shot #62												
HP-1-5	1340	730	20	46100	605	4496	151.9	4586	28.2	4406	29.8	
Shot #63												
HP-2-5	1325	730	20	37400	596	4564	151.9	4526	26.1	/	28.0	4429
Shot #64												
HP-1-6	1300	700	20	35400	606	4488	151.0	4479	23.1	/	27.0	4197
Shot #65	1290	700	20	35300	636	4277	150.9	4464	19.2	4309	26.9	4334
HP-2-6												

[illegible]	velocity [illegible]	1st plate	2nd plate	3rd plate	projectile wt	Tot. package wt.	Date.	Remarks.
								Test #: (Target) TT-13 Est vel: 5100
30.1	N/A.	C	C	C	1115.8	1596.1	2/16/89	
90.0	/	C	C	HB	1002.1	1596.1	2/17/89	Test #: TT-14 est. vel: 4800 f/s.
90.2	N/A.	C	C	C	1001.9	1711.3	2/17/89	Target (Test): TT-15 est vel: [illegible]
60.0	N/A.	C	C	C	1001.4	1709.7	2/17/89	Target (Test) #: TT-16 est. vel: 4600
					~~993.5~~	~~1795.7~~	~~5/2/89~~	~~Target #: TT-17 (1") Est. vel: 4600~~
59.5	N/A	C	C	C	993.5	1795.7	5/2/89	Target #: TT-17 (1") Est. vel: 4600 f/s
/	N/A	C	C	C	1015.9	1757.8	5/2/89	Target #: TT-18 (1") Est vel: 4600 f/s
99.9	/	C	C	NB	991.7	1770.8	5/4/89	Target #: TT-19 (1") Est vel: 4400 f/s
99.9	/	C	C	NB	1009.7	1747.6	5/4/89	Target #: TT20 (1") est vel: 4400 f/s

Tungsten Smooth barrel 20mm" x 11' Single target: 63°
30mm. base electric primer

Rd #	WEB .029	WEB .015	Bl. powder	Cu. PRESSURE	Instr. Reading	Instr. velocity	TIMER 1/2	velocity 1/2	TIMER
R Shot #38									
S REF E-1-1	1360	750	20	N/A	602	4900	159.9	4958	69.0
RE Shot #39									
S REF E-1-2	1480	770	20	59700	618	4773	156.0	5054	/
RE Shot #40									
S REF-E-2-1	1420	770	20	57300	579	5095	N/A	N/A	N/A
RE Shot #41									
S REF-E-2-2	1445	785	20	61900	576	5122	156.0	5145	69.0
E Shot #42									
REF-E-2-3	1430	775	20	61300	572	5157	156.0	5122	60.2
Shot #43									
S REF-E-2-4	1460	795	20	65800	565	5221	156.1	5208	70.2
H Shot #44	1390								
EP1-2	1390	790	20	59500	592	4983	135.9	4967	70.2
S Shot #45									
H EP2-3	1470	840	20	73700	559	5277	118.0	5232	70.2
Shot #46									
S EP-3-1	1470	830	20	72300	571	5166	120.9	5144	70.1
H Shot #47									
EP3-2	1450	800	20	67300	N/A	N/A	130.0	4963	70.1
S									
H Shot #48									
EP-4-1	1400	770	20	58600	592	4983	134.0	4959	80.2
Shot #49	1480	830	20						
EP4-2	1480	830	20	71800	565	5221	124.0	5186	100.1
Shot #50									
EP-5-1	1370	740	20	40600	/	/	124.0	4807	100.1

baseline : 2.95' A.R.A.P. Dick Swedeker

Timer velocity	projectile wt.	Total package wt.	Date	penetration	REMARKS
					Estimated vel: 2922 F/s.
✓	989.3	1582.2	2/13/89	MB	Test # RHA-13, Target #13
	1004.8	1599.4	2/13/89		Target #14
✓			2/13/89	LBwC	
	1002.7	1597.7	2/13/89	LB	Target #15 RHA-15
✓					
N/A	1002.7	1595.4	2/14/89	C	Test #: RHA-16 est. vel. 5100 F/s
✓	1002.6	1592.9	2/14/89	LB	Target # QS-81
✓	999.6	1593.9	2/14/89	LB	Target QS-82
~~N/A~~	1005.2	1713.8	2/14/89	NB	Target RHA-18 estimated: 4951 F/s
✓	1002.4	1710.8	2/14/89	LB w/c.	Target RHA-20 estimated vel: 5100
N/A	1003.1	1769.9	2/14/89	C	Target RHA-21 est. vel: 5100.
N/A	1003.0	1773.8	2/14/89	C	Target RHA-22 est. vel: 5000
✓	995.6	1723.0	2/15/89	N/B	Target RHA-23 est. vel: 4900 F/s
✓	996.6	1721.6	2/15/89	N/B	Target RHA-24
✓	904.6	1402.9	2/15/89	N/B	Target # RHA-25 estimated: 5200 F/s

baseline: 2.95' SAME AS LAST PAGE

Rd #	029	015	BL powder	CU pressure	Inst Tr reading	Inst. velocity	Timer 1/2	velocity 1/2	Timer
Shot #51									
EP2-4	1440	810	20	71200	573	5148	136.9	5092	100.3
~~Shot #52~~	~~1430~~	~~800~~	~~20~~		~~578~~		~~136.9~~		~~100.3~~
EP2-5	1430	800	20	64100	578	5104	136.9	5060	100.3
Shot #53									
EP3-3	1400	760	20	58500	602	4900	137.0	4869	100.3
Shot #54									
EP3-4	1440	790	20	68300	580	5086	137.0	5027	100.2
Shot #55	1445								
EP4-3	[illegible]	810	20	55900	584	5051	136.0	4997	100.1
Shot #56									
EP4-4	1490	830	20	68300	570	5175	136.0	5095	100.3
Shot #57									
EP5-3	1400	760	20	42500	588	5015	136.0	4981	100.3
shot #66									Timer 6
HP-1-1	1400	745	20	50,000	620	4758	152.7	4741	99.8
Shot #67									
HP2-1	1410	745	20	55,100	615	4797	152.9	4773	100.0
Shot #68									
HP-1-2	1440	780	20	58400	598	4933	152.9	/	100.0
Shot #69									
HP-2-2	1390	780	20	44100	627	4705	155.0	4677	99.9
~~HP-1-3~~ Shot #70									
HP1-3	1410	760	20	56500	612	4820	153.0	4784	/
Shot #71									
HP2-3	1310	640	20	32000	671	4396	164.9	4371	/
Shot #72						4908			
HP1-4	1440	790	20	64600	601	~~4911~~	147.9	4889	100.0
Shot #73									
HP2-4	1360	700	20	38600	646	4567	147.9	4549	/

shot #	projectile weight	package wt	Date	penetration	remarks.
					Target QS-83 est. vel: 5100 f/s
N/A	1005.6	1713.7	2/16/89	C	projectile hit bottom of frame
N/A	1002.2	1708.1	2/16/89	C	Target QS-84 est. vel: 5050
	1003.8	1773.3	2/16/89	M/B	Target QS-85 est. vel: 4800 f/s
771	1003.4	1770.8	2/16/89	C	Target QS-86 est. vel: 5000 f/s
	995.0	1721.2	2/16/89	NB	Target QS-87 est. vel: 5050 f/s.
	996.3	1721.8	2/16/89	SB	Target QS-88 est. vel: 5200 f/s
N 6/7.	921.6	1420.1	2/16/89	NB	Target QS-89 est. vel: 5200 f/s
	995.9	1788.2	5/4/89	V.S.B.	Target RHA#26 (2") est. vel: 4800 f/s.
	1005.7	1766.8	5/4/89	C	Target RHA # 27 (2") Est. vel: 4800 f/s.
	~~993.0~~	~~1780.6~~	~~5/5/89~~		
	993.0	1780.6	5/5/89	LB.	Target RHA # 28 (2") Est vel: 4900 f/s.
	1017.8	1756.6	5/5/89	C	Target RHA # 29 (2") Est. vel: 4800 f/s
	991.8	1783.1	5/5/89	MB	Target: QS-90 Est vel: 4800 f/s
	1014.3	1758.7	5/5/89	NB	Target: QS-91 Est vel: 4800 f/s
	994.7	1788.5	5/5/89	LB	Target: QS-92 Est vel: 4900 f/s
	1016.2	1763.5	5/5/89	MB	Target: QS-93 Est vel: 4800 f/s

MISCELLENOUS BUILDING 611B TESTS

SMALL ARMS COPPER PRESSURE CYLINDERS (UNCOMPRESSED)
MANUFACTURED AND ANNEALED AT FRANKFORD ARSENAL 1965
SET IN 0.0001 INCH VS. CHAMBER PRESSURE (LBS. PER SQ. IN.) USING 1/30 SQ. IN. PISTON
MEAN LENGTH .4002 INCH - MEAN DIAMETER .2282 INCH
COMPRESSIONS MADE AT FRANKFORD ARSENAL, JANUARY 1966
CYLINDER DRAWING A5039436
LOT NO. 3C-65 SIZE OF LOT 59,000 APPROX.

SET IN INCHES	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009
.0030	8700	8800	9000	9100	9200	9300	9500	9600	9700	9800
.0040	9900	10100	10200	10300	10400	10500	10600	10800	10900	11000
.0050	11100	11200	11300	11400	11600	11700	11800	11900	12000	12100
.0060	12200	12300	12400	12500	12600	12800	12900	13000	13100	13200
.0070	13300	13400	13500	13600	13700	13800	13900	14000	14100	14200
.0080	14300	14400	14500	14600	14700	14800	14900	15000	15100	15200
.0090	15300	15400	15500	15600	15700	15800	15900	16000	16100	16200
.0100	16300	16400	16500	16600	16700	16800	16800	16900	17000	17100
.0110	17200	17300	17400	17500	17600	17700	17800	17900	18000	18100
.0120	18100	18200	18300	18400	18500	18600	18700	18800	18900	19000
.0130	19000	19100	19200	19300	19400	19500	19600	19700	19800	19800
.0140	19900	20000	20100	20200	20300	20400	20500	20500	20600	20700
.0150	20800	20900	21000	21100	21100	21200	21300	21400	21500	21600
.0160	21600	21700	21800	21900	22000	22100	22100	22200	22300	22400
.0170	22500	22600	22600	22700	22800	22900	23000	23100	23100	23200
.0180	23300	23400	23500	23500	23600	23700	23800	23900	24000	24000
.0190	24100	24200	24300	24400	24400	24500	24600	24700	24700	24800
.0200	24900	25000	25100	25100	25200	25300	25400	25500	25500	25600
.0210	25700	25800	25800	25900	26000	26100	26200	26200	26300	26400
.0220	26500	26600	26600	26700	26800	26900	26900	27000	27100	27200
.0230	27200	27300	27400	27500	27500	27600	27700	27800	27800	27900
.0240	28000	28100	28100	28200	28300	28400	28400	28500	28600	28700
.0250	28700	28800	28900	29000	29000	29100	29200	29300	29300	29400
.0260	29500	29600	29600	29700	29800	29800	29900	30000	30100	30100
.0270	30200	30300	30300	30400	30500	30600	30600	30700	30800	30800
.0280	30900	31000	31100	31100	31200	31300	31400	31400	31500	31600
.0290	31600	31700	31800	31800	31900	32000	32100	32100	32200	32300
.0300	32300	32400	32500	32600	32600	32700	32800	32800	32900	33000
.0310	33000	33100	33200	33300	33300	33400	33500	33500	33600	33700
.0320	33700	33800	33900	33900	34000	34100	34100	34200	34300	34400
.0330	34400	34500	34600	34600	34700	34800	34800	34900	35000	35000
.0340	35100	35200	35200	35300	35400	35400	35500	35600	35600	35700
.0350	35800	35800	35900	36000	36000	36100	36200	36200	36300	36400
.0360	36400	36500	36600	36600	36700	36800	36800	36900	37000	37000
.0370	37100	37200	37200	37300	37400	37400	37500	37600	37600	37700
.0380	37800	37800	37900	38000	38000	38100	38200	38200	38300	38400
.0390	38400	38500	38600	38600	38700	38700	38800	38900	38900	39000
.0400	39100	39100	39200	39300	39300	39400	39500	39500	39600	39700
.0410	39700	39800	39800	39900	40000	40000	40100	40200	40200	40300
.0420	40400	40400	40500	40500	40600	40700	40700	40800	40900	40900
.0430	41000	41100	41100	41200	41200	41300	41400	41400	41500	41600
.0440	41600	41700	41700	41800	41900	41900	42000	42100	42100	42200
.0450	42200	42300	42400	42400	42500	42600	42600	42700	42700	42800
.0460	42900	42900	43000	43100	43100	43200	43200	43300	43400	43400
.0470	43500	43500	43600	43700	43700	43800	43900	43900	44000	44000
.0480	44100	44200	44200	44300	44300	44400	44500	44500	44600	44600
.0490	44700	44800	44800	44900	45000	45000	45100	45100	45200	45300
.0500	45300	45400	45400	45500	45600	45600	45700	45700	45800	45900
.0510	45900	46000	46000	46100	46200	46200	46300	46300	46400	46500
.0520	46500	46600	46600	46700	46800	46800	46900	46900	47000	47100
.0530	47100	47200	47200	47300	47400	47400	47500	47500	47600	47600
.0540	47700	47800	47800	47900	47900	48000	48100	48100	48200	48200
.0550	48300	48400	48400	48500	48500	48600	48600	48700	48800	48800
.0560	48900	48900	49000	49100	49100	49200	49200	49300	49300	49400
.0570	49500	49500	49600	49600	49700	49800	49800	49900	49900	50000
.0580	50000	50100	50200	50200	50300	50300	50400	50400	50500	50600
.0590	50600	50700	50700	50800	50800	50900	51000	51000	51100	51100
.0600	51200	51300	51300	51400	51400	51500	51500	51600	51700	51700
	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009

SET IN INCHES	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009
.0560	48900	48900	49000	49100	49100	49200	49200	49300	49300	49400
.0570	49500	49500	49600	49600	49700	49800	49800	49900	49900	50000
.0580	50000	50100	50200	50200	50300	50300	50400	50400	50500	50600
.0590	50600	50700	50700	50800	50800	50900	51000	51000	51100	51100
.0600	51200	51300	51300	51400	51400	51500	51500	51600	51700	51700
.0610	51800	51800	51900	51900	52000	52000	52100	52200	52200	52300
.0620	52300	52400	52400	52500	52600	52600	52700	52700	52800	52800
.0630	52900	53000	53000	53100	53100	53200	53200	53300	53300	53400
.0640	53500	53500	53600	53600	53700	53700	53800	53900	53900	54000
.0650	54000	54100	54100	54200	54200	54300	54400	54400	54500	54500
.0660	54600	54600	54700	54700	54800	54900	54900	55000	55000	55100
.0670	55100	55200	55200	55300	55400	55400	55500	55500	55600	55600
.0680	55700	55700	55800	55900	55900	56000	56000	56100	56100	56200
.0690	56200	56300	56300	56400	56500	56500	56600	56600	56700	56700
.0700	56800	56800	56900	56900	57000	57100	57100	57200	57200	57300
.0710	57300	57400	57400	57500	57500	57600	57700	57700	57800	57800
.0720	57900	57900	58000	58000	58100	58100	58200	58200	58300	58400
.0730	58400	58500	58500	58600	58600	58700	58700	58800	58800	58900
.0740	58900	59000	59100	59100	59200	59200	59300	59300	59400	59400
.0750	59500	59500	59600	59600	59700	59800	59800	59900	59900	60000
.0760	60000	60100	60100	60200	60200	60300	60300	60400	60400	60500
.0770	60600	60600	60700	60700	60800	60800	60900	60900	61000	61000
.0780	61100	61100	61200	61200	61300	61300	61400	61500	61500	61600
.0790	61600	61700	61700	61800	61800	61900	61900	62000	62000	62100
.0800	62100	62200	62200	62300	62300	62400	62400	62500	62600	62600
.0810	62700	62700	62800	62800	62900	62900	63000	63000	63100	63100
.0820	63200	63200	63300	63300	63400	63400	63500	63500	63600	63600
.0830	63700	63800	63800	63900	63900	64000	64000	64100	64100	64200
.0840	64200	64300	64300	64400	64400	64500	64500	64600	64600	64700
.0850	64700	64800	64800	64900	64900	65000	65000	65100	65100	65200
.0860	65200	65300	65400	65400	65500	65500	65600	65600	65700	65700
.0870	65800	65800	65900	65900	66000	66000	66100	66100	66200	66200
.0880	66300	66300	66400	66400	66500	66500	66600	66600	66700	66700
.0890	66800	66800	66900	66900	67000	67000	67100	67100	67200	67200
.0900	67300	67300	67400	67400	67500	67500	67600	67600	67700	67700
.0910	67800	67800	67900	67900	68000	68000	68100	68100	68100	68200
.0920	68300	68300	68400	68400	68500	68500	68600	68600	68700	68700
.0930	68800	68800	68900	68900	69000	69000	69100	69100	69200	69200
.0940	69300	69300	69400	69400	69500	69500	69600	69600	69700	69700
.0950	69800	69800	69900	69900	70000	70000	70100	70100	70200	70200
.0960	70300	70300	70400	70400	70500	70500	70600	70600	70700	70700
.0970	70800	70800	70900	70900	71000	71000	71100	71100	71200	71200
.0980	71300	71300	71400	71400	71500	71500	71600	71600	71700	71700
.0990	71800	71800	71900	71900	72000	72000	72100	72100	72200	72200
.1000	72800	72300	72400	72400	72500	72500	72600	72600	72700	72700
.1010	72800	72800	72900	72900	73000	73000	73100	73100	73100	73200
.1020	73200	73300	73300	73400	73400	73500	73600	73600	73600	73700
.1030	73700	73800	73800	73900	73900	74000	74000	74100	74100	74200
.1040	74200	74300	74300	74400	74400	74500	74500	74600	74600	74700
.1050	74700	74700	74800	74800	74900	74900	75000	75000	75100	75100
.1060	75200	75200	75300	75300	75400	75400	75500	75500	75600	75600
.1070	75700	75700	75800	75800	75900	75900	76000	76000	76000	76100
.1080	76100	76200	76200	76300	76300	76400	76400	76500	76500	76600
.1090	76600	76700	76700	76800	76800	76900	76900	77000	77000	77100
.1100	77100	77100	77200	77200	77300	77300	77400	77400	77500	77500
.1110	77600	77600	77700	77700	77800	77800	77900	77900	78000	78000
.1120	78000	78100	78100	78200	78200	78300	78300	78400	78400	78500
.1130	78500	78600	78600	78700	78700	78800	78800	78900	78900	78900
.1140	79000	79000	79100	79100	79200	79200	79300	79300	79400	79400
.1150	79500	79500	79600	79600	79700	79700	79700	79800	79800	79900
.1160	79900	80000	80000	80100	80100	80200	80200	80300	80300	80400
.1170	80400	80400	80500	80500	80600	80600	80700	80700	80800	80800
.1180	80900	80900	81000	81000	81100	81100	81100	81200	81200	81300
.1190	81300	81400	81400	81500	81500	81600	81600	81700	81700	81800
.1200	81800	81800	81900	81900	82000	82000	82100	82100	82200	82200
.1210	82300	82300	82400	82400	82400	82500	82500	82600	82600	82700
.1220	82700	82800	82800	82900	82900	83000	83000	83100	83100	83100
.1230	83200	83200	83300	83300	83400	83400	83500	83500	83600	83600
.1240	83600	83700	83700	83800	83800	83900	83900	84000	84000	84100
.1250	84100	84100	84200	84200	84300	84300	84400	84400	84500	84500
	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009

SPECIAL TEST JIM BEETLE X6345

VS: 1" plate 14', smoot Bore barrel

12-21-79

SHOT	CHG 4996	GRAINS PENETRATOR WT.	X-RAY TIME	VELOCITY M/S	INST TIME
3-1-343Q1	300 GR				1770
-2 343Q2	[illegible]		275.0		965.3
-2 343Q3	300 GR	279.9	640.7		1052.6
6-9 343Q4	200 GR	280.9	288.2	420.27	1348.8
343Q5	250 GR	277.9	276.5	432.99	1297.3
343Q6	350 GR	282.7	275.0	381.63	1553.2
343Q7	600 GR	278.4	280.0	675.00	883.4
343Q8	150 GR	283.6	300.7	290.2	1892.7
4-80-310A-9	500 GR	280.4	341.1		978.1
310Q1-10	500 GR	282.2	341.4		1025.4
1 313A-11	500 GR	281.8	342.4		1010.
313Q1-12	500 GR	280.0	349.3		935.9
5-80-341A-13	500 Gr.	281.1	332.3		1000.8
1--241Q1-14	500 Gr	281.0	332.8		995.5
1-343Q9-15	700 Gr.	281.6	354.6		709.6
-310Q2-16	200 Gr	279.3	359.2		1662.4
9-80 313Q2-17	200 Gr	281.6	690.9		2533.9
1 341Q2-18	200 Gr.	280.3	489.3		3498.0

Base Line 1.942

30 M/m Fat 15E1 Case x 7" Chamber

Pwdr. IMR 4996

Inst Velo	Remarks
1097	Recovered Projectile intact ¼" Penetration in Plate
1175	Projectile Stuck into Plate (intact) + Removed
1845	Projectile same as above (very easily Removed
1496	Projectile stuck into Plate (intact) + Removed
1497	Same as Shot Q4
1250	Projectile Lose in Box Penetration appx ¼"
2198	Projectile Stuck and Lose not Removed
1026	Recovered Projectile (intact) ¼ Penetration
1965	Recovered Proj. Intact Flattened
1894	Projectile stuck in plate
1923	Recovered Proj. Intact Flattened
2075	Recovered Proj. intact Approx. ⅔ penetratio
1940	Recovered Proj. intact Flattened
1951	Projectile stuck in plate
2737	Recovered ¾ of proj. rest broke off in plate. approx ½" deep small Bulge in plate
1168	Recovered Proj. intact
766	Recovered Proj. intact
555	Recovered Proj intact

Different Special... Tests to check characteristic effects of material

Shot	Charge	Inst Vel	Vel	Pressure	X-RAY Time	X-RAY Vel	Time 4-5
Test Shot 2-26-80 Tungsten	780 grains IMR 4996 lot #1030	1231.8		None	298.5		117.8
2-27-80 T1	800	992.0	2819	None	282.1		118.4
3-6-80 ST-6 Proj #KL-6	930 IMR 4996	786.8	3555		283.1		120.5
3-7-80 ST-7	910 [illegible] IMR [illegible]	826.5	338[illegible]		283.9		102[illegible]

Base Line $33\frac{9}{16}" = 2.797'$

$65^{\circ} = 444.5$ MILS

Vel 4-5	Time 6-7	Vel 6-7	Time 8-9	Vel 8-9	Penetration .1	.250	.500	Remarks
	123.4		515.5		C	C	?	Projectile-WE 704.0 grains
	122.9		516.7		C↕6	C↕100	SB 130↕	Proj WE 1004.5 grains
	None		None		C↕	NO Plate	NO Plate	Proj WE 704.5 grains
								Test Special to determine effect on -1 Plate by SABOT
	None		None		C↕	NO Plate	NO Plate	Projectal WE 1000. grains
								1 plate w/ sabot drilled 6 Holes

*C↕ Vertical

Preliminary Test Shots to get 5000 FPS for a future Test-Firing into 2" plates

Powder Propellant IMR 4996-(Take note powder change)

.Staballoys

Rd # or Shot	Grains Charge	Instant Velocity	Velocity	Copper Pressure	1 & 2 X-Ray Time	1 & 2 X-Ray Velocity	8 & 9 X-Ray Time	8 & 9 X-Ray Velocity
1	1150	771.6		20600	208.6	3809	167.6	
2	1250	693.7		33700	211.0	4219	167.8	
3	1400	643.7	4547	57900	179.1	4575	No Reading	
4	1500	606.9		70800	155.2	4842	145.5	
5	1650	581.6	5032	65900	156.1	4992	None	
6	1750	652.9	4483	76100	158.4	5164	None	
7	1550	618.1	4735	63800	160.0	4783	None	
8	1660	596.5	4907	66200	163.7	4907	163.7	
9	1400	211.0	4016	26200	211.0	4039	None	
10	1600	705.7	4147	To Low ?	211.4	4209	None	
11	1800	633.7	4619	40500	214.8	4589	None	
12	1900	615.0	4759	53300	180.3	4760	None	
13	2050	602.9	4854	70000	184.7	4894	None	
—	—	—	—	—	—	—	—	—
14	2050	606.7	4824	70100	No Reading	~~####~~	None	
—	—	—	—	—	—	—	—	
#138 15	2050 Copper Low +	641.7 Gage Had 2 High Spots	4561	2 readings High 82200 Low 77300	181.0	4856	165.8	
#82 16	1680 Charge Black Pwdr 20 grain		3985	26100	212.1	3993	None	
17 #83	1740 charge Black Pwdr 20 grs.	708.7	4130	45300	213.1	—	None	
#88 #18	1820 charge Black Pwdr 20 grs.	682.3	4290	35200	189.2	4305	None	

14' Barrel 20 M/M Smooth Bore - Base line 35-125 = 2-927

30 M/M case Fat 15E1 - Elect Primers M52A3B1

#				Chamber Size	Remarks	Projectile Weight	Date
1				7"	Package Weight 1535.4 Grains	1003.2	4-17-80
2				7"	1537.9 "	1003.3	4-17-80
3				7"	1540.5 "	1007.0	4-17-80
4				7"	1536-5 "	1000.0	4-18-80
5				8" Change	1531.1 "	999.5	4-18-80
6				8" "	1533.9 "	10040	4-18-80
7				8" "	1540.8 "	1007.0	4-18-80
8	Changed Powder From IMR4996 to MC-25-FS			8" Staballoy	1535.1 "	10040	4-21-80
9		"		9" Staballoy	1537.2 "	1003.8	4-23-80
10		"		9" Change Staballoy	1540.6 "	1003.8	4-23-80
11		"		9" Staballoy	1533.6 "	1003.7	4-24-80
12		"		9" Staballoy	1554.0 "	1003.3	4-24-80
13		"		9" Staballoy	1668.2 " Added Two extra pushers	1003.3	4-25-80
—	—	—	—	—	—	—	—
14		"		9" staballoy	1684.3 " Added 1 extra Disc + 2 pusher	1004.3	4-30-80
—	—	—	—	—	—	—	—
15		"		9" Staballoy	1686.8 " 2 Disc 2 pusher	1003.5	5-1-80
16	Changed Powder. Black Pwdr. 20 grains Lot CIL-7-5 MP30 WEB-.0317-1680 grs Lot-RAD-69315			9" staballoy	1669.9 2 Disc	1003.7	5-18-80
#17	BLack Pwdr 20 grains Lot CIL-7-5 MP30 WEB-.0317 1740 grs Lot-RAD-69315			9" "	2 Disc 1664.2	1004.5	5-18-80
* 18	Black Pwdr-20 grains Lot CIL-7-5 MP30 WEB-.0317-1820 grs Lot-RAD-69315				1665.7 2 Disc	1004.0	6-18-80

Test for ~~Check~~ Rhoades to determine stability of (M60 M.G. 7.62 M/M) sabot

(Base Line 23.3125" = 1.942')

Rd + Date		Instant Velocity	Vel	XRay Time	XRay Vel			Remarks
6-9-80 7.62 M/M Ball		720.6	2695	149.7				
6-9-80 Remington Sabot 7.62 M/M ~~Case~~		603.1	3220	197.6				

Continued from last page

Preliminary Test Shots to get 5000 ft P.S.
Firing into 2" Armor plates
Pwdrs used have changed see below.

Rd or Shot #	Grains Charge	Instant Velocity	Velocity	Copper Pressure	1+2 X-Ray Time	1+2 X-Ray Velocity	8+9 X-Ray Time	8+9 X-Ray Velocity
#19 89	1800 M30 20 BLK		4223	27,900	1775	4228		
20 90	1802 M30 30 BLK		4264	26400	1791	4276		
#21 93	1000-4996 gn-M30	6472	4523	62,200	1671	4871		
#22 99	1770	736	3977	22200	180.2	4002		
#23 96	1820	668	4382	31600	180.3	3992		
#24 107	1845	654	4475	33000	182.2	4493		
#25 105	1820	652	4489	34400	179.9	4495		
#26 108	1920	607	4822	49000	181.5	4822		
#27 #27	1990	584	5114	64500	182.3	5010		
Shot 28 Rd #91	2060	572	5126	68800	161.6	5114		
Shot 29 Rd #97	1990	590	4961	58600	165.7	4951		
Shot 30 Rd #74	2000	587	4986	64300	166.8	5004		
Shot-31 Rd # 98-243	2000	585	5003	62800	157.9	5020	127.4	

14' Barrel 20 M/M Smooth bore - Baseline (35-125=2.927)
-30 M/M case Fat IBE1 - Elect Primers M52A3B1

		Chamber Size	Remarks	Projectile Weight	Date
#19 Rd 89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
#20 Rd 90	[illegible]				
#21	EMR 4996 - 1000 GR				
Rd 93	MP M30 WEB-0317-900GR	9" STABALLOY	1664.5 2DISC	1004.0	6-24-80
#22	Black Pwdr 20 grains M30-.0317 WEB 1575 grs.	9"	1664.8	1003.5	7-10-80
	M30-.0152 WEB 175 grs.	Staballoy			
#23	Black Pwdr-20 grains M30-.0317 WEB-1620 grs	Staballoy	1666.8	1004.0	7-10-80
Rd # 96	M30-.0152 WEB-180 grs				
#24	Black Pwdr - 20 grains M30-.0317 WEB-1600 grs.	Staballoy 9" Chamber	1664.0	1003.5	7-10-80
Rd #107	M30-0152 WEB 225 grs				
#25 +05	Black Pwdr - 20 grains M30-.0317 WEB 1440 grs	Staballoy 9" Chamber	1650.6 1670.2	1003.0 1003.5	7-14-80 7-14-80
	M30-0152 WEB 360 grs.				
	Black Pwdr 20 grs M30 .0317 WEB 1330 grs M30 .0152 WEB 510 grs	9" Chamber Staballoy	1670.2	1003.5	7-14-80
#27 Rd 127	Black PWDR 20 grs M30-.0317 1210 grs. M30-.0152 760 grs	9" Chamber Staballoy	1660.3	1004.0	7-21-80
28 Rd 91	Black Pwdr - 20 gr. M30-.0317-1280 grs. M30-.0152 - 760 grs	9" Chamber Staballoy	1659.8	1004.5	7-21-80
29 Rd 97	Black Pwdr - 20 grs. M30-.0317 - 1210 grs. M30-.0152 760 grs	9" Chamber Staballoy	1667.8	1005.8	7-22-80
30 Rd #74	Black Pwdr - 20grs M30-.0317-1220 grs M30-.0152-760 grs	9" Chamber Staballoy	1661.3 60° Obliquity	1004.5	7-22-80
Shot #30 Rd # 898-243	Black Pwdr - 20grs M30-.0317-1220 grs M30-.0152-760 grs.	9" Chamber	1556.0	1006.0	7-30-80

Continued from last page

Rd or Shot	Grains Charge	Instant Velocity	Velocity	Copper Pressure Chamber	#2 X-Ray Time	#2 X-Ray Velocity	#3 X-Ray Time	#3 X-Ray Velocity
#32 Rd #129	2000	582	5029	62300	155.5	5053	126.7	
33 Rd # 106	1995	578	5064	62800	157.7	5078	1005	
# 34 Rd 111	1985	578	5064	62400	158.5	5044	99.8	
35 76	1980	572	5126	61300	157.6	5020	101.7	
36 Rd 81	1980	592	4944	60000	152.3	4984	103.1	
37 Rd # 73	1980	~~585~~ 577	5072	64200	155.5	5043	104.3	
38 Rd 87	1980	585	5003	65500	154.8	5035	103.6	
39 Rd # 94	1980	585	5003	64800	156	5020		

30 M/M Fat Case 1.5 E1
20 M/M - 14' Smooth Bore Barrel
Elect. Primer - M52A3B1

Base Line (35.125 = 2.927)
VISITOR BADGE 117 DICK SAFDIA
119 ROSS CATALDO

	Powder Weight	~~Chamber Size~~	Package Weight	Projectile Weight	Chamber size	Date
33 #129	Lot Rad-69315-1200 grs-.0317 web " Rad-E-30-760 grs-M30 Web .0152 20 grains Black Pwdr.		1561.8	1004.0	9"	7-31-80
	Beginning of ARAP project					
33 #26	Lot 69315 1215 gr .0317 web Lot Rad-E-30-760 gr .0152 web 20 gr BP.		1545.0	1003.5	9"	8-1-80
11 #34	Lot 69315 1205 gr .0317 web ~~Lot RAD E-30 760 gr~~ .0152 20 gr BP.		1542.6	1004.0	9"	8-1-80
#35 #76	Lot 69315-1200 grains .0317 Web ~~Lot RAD E-30 760 "~~ .0152 " 20 gr Black Pwdr.		1544.6	1003.8	9"	8-8-80
#36 #81	Lot 69315-1200 grains .0317 Web ~~Lot RAD E-30 760 grs.~~ .0152 Web 20 grs Black Pwdr.			1004.5	9"	8-8-80
SHOT #37 #73	LOT 69315-1200 GRNS 0317 web LOT RAD E-30 760 GRS. 0152 web 20 GRNS. BLACK PWD.		1541.6	1003.0	9"	8-11-80 ECR
SHOT #38 #87	Lot 69315-1200 GRNS 0317 WEB Lot RAD E-30 760 GRNS 0152 WEB 20 GRNS. BLACK PWD.		1548.1	1004.0	9".	8-11-80 ECR
SHOT #39 #94	LOT 69315-1200 GRNS 0317 WEB LOT RAD E 30 760 GRNS 0152 WEB 20 GRNS BLACK PWD		1522.9	1003.7	9"	8-12-80 ECR

CONTINUED FROM LAST PAGE 8-14-80 MR. ROSS CONTILIANO PAGE #124

MR. DICK SNEDEKER #122

SHOT	GRAINS CHARGE	INST VEL TIME	INST VEL	COPPER CRUSHER	1-2 TIME	VEL 1-2	2-4 TIME
SHOT #							
40 RD 95	2005	575	5090	69.100	155.7	5081	101.8
41 RD 98	1980	588	4978	PISTON BROKE ~~76.600~~	157.1	5023	102.1
42 RD. 100	1980	581	5038	66.100	157.8	5076	104.9
43 RD. 101	1980	582	5029	66.200	158.9	5040	NONE
44 RD. 104	1980	582	~~5029~~	70.000	158.0	5029	100.6
45 RD. 125	1980	591	4953	67.200	157.2	5013	101.5
46 RD # 109	1980	588	4978	65.100	158.8	5017	96.9
47 RD # 85	1980	588	4978	70.800	157.2	5025	93.2
48 RD # 86	1980	582	5029	65.600 ~~5026~~	158.3	5037	92.1

BASE LINE
35.125" = 2.927

30 MM FAB CASE 15E1
20mm - 14' smooth BORE BBL.
ELECT PRIMER - M52A3B1

Powder WT	Package	Proj WT	Chamber	Date
SHOT #40 RD# 95 LOT 69315 - 1225 GRNS 0317 WEB LOT RAD E30 760 GRNS 0152 WEB 20 GRNS BLACK POWDER	1540.8	1003.5	9"	8-12-80 RCB
	1539.3	1003.4	9"	8-13-80 RCB
SHOT 41 LOT 69315 - 1200 GRNS 0317 WEB RD #98 LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS. BLACK PWD.				
SHOT 42 LOT 69315 - 1200 GRNS 0317 WEB RD. 100 LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS. BLACK PWD.	1531.7	1003.4	9"	8-13-80 RCB
SHOT 43 LOT 69315 - 1200 GRNS 0317 WEB RD. 101 LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS. BLACK PWD.	1539.2	1003.9	9"	8-13-80 RCB
SHOT 44 RD# 104 LOT 69315 - 1200 GRNS 0317 WEB LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS. BLACK PWD.	1538.5	1003.4	9"	8-13-80 RCB
SHOT 45 LOT 69315 - 1200 GRNS 0317 WEB RD# 125 LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS BLACK POWDER	1542.3	1003.7	9"	8-14-80 RCB
SHOT 46 LOT 69315 - 1200 GRNS 0317 WEB RD. 109 LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS BLACK PWD.	1538.5	1004.0	9"	8-14-80 RCB
SHOT 47 LOT 69315 - 1200 GRNS 0317 WEB RD. 85 LOT RAD E-30 760 GRNS 0152 WEB 20 GRNS BLACK POWDER	1536.4	1003.5	9"	8-14-80 RCB
SHOT 48 LOT 69315 - 1200 GRNS 0317 WEB RD. 86 LOT RAD E-30 760 GRNS. 0152 WEB 20 GRNS. BLACK POWDER	1534.9	1003.9	9"	8-14-80 RCB

CONT FROM LAST PAGE MR. CONTILIANO BADGE # 121
MR. SMIEJEKE BADGE # 122

SHOT	GRAINS CHARGE	FIRST VEL. TIME	FIRST VEL.	COPPER PRESS.	1-2 TIME	1-2 VEL.	8-9 TIME	8-9 VEL.
49 RD# 112	1980	591	4953	PISTON BROKE	155.9	4949	91.6	
50 RD# 117	1980	582	5029	PISTON BROKE	157.4	~~4949~~	91.8	
51 RD# 118	1980	631	4639	67.400	157.6	5040	102.8	
52 RD# 140	1890	621	4713	61.900	157.6	4726	102.9	

30 mm FAT CASE 15E1
20 mm 14" SMOOTH BORE BBL.
Elect. PRIMERS MS2A8B1

BASE UNIT
35.625 = 2.927

SHOT	POWDER WT.	PACKAGE WT	PROJ WT	CHAMBER	DATE
49 RD #112	Lot 69315-1200 GRNS .0317 WEB LOT RAD E-30 760 GRNS .0152 WEB 20 GRNS BLACK PWD.	1537.1	1003.1	9"	8-15-80 RCB
50 RD #117	LOT 69315-1200 GRNS .0317 WEB LOT RAD E-30 760 GRNS .0152 WEB 20 GRNS BLACK PWD.	1521.0	1004.0	9"	8-15-80 RCB
51 RD 118	LOT 69315-1200 GRNS .0317 WEB LOT RAD E-30 760 GRNS .0152 WEB 20 GRNS BLACK PWD.	1538.2	1003.1	9"	8-15-80 RCB
52 RD #110	LOT 69315 1350 GRNS .0317 WEB Lot RAD E-30 [illegible] .520 GRNS .0152 WEB 20 GRNS BLACK POWDER	1535.8	1002.9	9"	8-15-80 RCB

20mm x 14" Barrel Smooth

Shot	Grains Charge	Inst Vel. Time	Inst Vel	Copper Press.	Time 1+2	Vel 1+2	T+9 Time	T+9 Vel	
Test #1 T-1	1980	105.4	4820	54100	[illegible]	4829	~~161~~		
	~~1980~~	[illegible]			~~158.8~~		~~246.4~~		
Test #2 T-2	1980	108.0 208.1			158.8		246.4		
Test #3 T-3	1980	617	4821	52950	150.7		418.1		
TEST #4									
Test 5				69401					
TEST 6		594	4935	50.400					
	ARAP	TARGET		TEST		STROBLEY			
AGUILA TEST #1	1980	592	4949	51.400	166.5	4950	415.1	—	20GR BLACK PWD
					steel CASE				
#2	1985	590	4966	59.400	169.7	4955	412.6		20 GRS BLACK PWD.
				BRASS	CASE				20 GR BLACK PWD
#3	1985	585	5009	59,600	174.5	4993	413.4		"
#4	1985	581	5043	54,100	175.2	5048	414.1		
#5	1985	587	4991	52.900	210.4	5009	412.4		
#6	1985	582	5034	53.200	165.9	5037	412.8		
#7	1985	581	5043	44100	165.6	5025	413.6		
#8	1985	577	5078	51900	165.5	5058	414.0		
#9	1980	590	4966	50200	[illegible]	4975	[illegible]		[illegible]
#10	1980	581	5043	[illegible]	164.5	[illegible]	415.3		"

Elec Primers M82A3B1

Base Line = 35.125 ± 2.927

Pwdr Weight		Package Wt. Grains	Proj. wt. Grains	Chamber	Date
Lot 69315 – 1200 grs. 0317 web Lot RAD-E-30-760 grs 0152 web 20 grs. Black Pwdr.		1547.0	1003.0	9" / 1" plate 60° Penetration	9-1-81
Lot 69315 – 1200 grs. 0317 Web Lot RAD-E-30-760 grs. 0152 Web 20 grs. Black Pwdr.		1550.5	1003.0	9" / 1" plate 60° Pent.	9-2-81
Lot 69315. 1200 grs 0317 Web Lot Rad-E-30 760 grs 0152 Web		1548.0	1003.0	9" / 2" plate 60° Pent.	9-3-81
LOT 69315 – 1220 grs 0317 WEB LOT RAD-E-30 780 grs 0152 WEB 20 GRS BLACK POWDER		1547.0	1003.5	9" / 2" PLATE 60° PENT	9-4-81
LOT 69315 – 1220 GRS 0317 WEB LOT RAD-E-30 780 grs 0152 web 20 GRS BLACK POWDER		1545.0	1002.5	9" / 2" PLATE 60° PENT	9-8-81
				BASELINE 2.93 ÷ 7	
LOT 69315 – 1200 GRS – 0317 WEB LOT RAD-E-30 – 760 GRS – 0152 WEB		1545.5	1003.0	9" / SPECIAL TARGET 60° PENT	9-9-81
Lot 69315 – 1200 GRS 0317 WEB Lot RAD-E-30 760 GRS 0152 WEB		1541.4	1003.7	9" / SPECIAL TGT. 60° PENT.	9-10-81
"	"			#1 #7 PENT.	9-10-81
"	"	1551.0	1003.0	" "	
				"	9-10-81
SAME CHARGE	SAME CHARGE	1549.5	1004.0	" #8 PENT.	
SAME CHARGE	SAME CHARGE	1545.0	1004.0	#9 PENT	9-11-81
SAME CHARGE	SAME CHARGE	1550.0	1003.5	#10 PENT	9-11-81
SAME CHG		1557.4	1003.0	18? R.V. #11 PENT.	9-11-81
SAME CHG.		1541.0	1003.0	#12 PENT	9-11-81
Lot 693.15-1200 grains 0317 WEB LOT RAD.E-30 760 grains 0152 WEB		1545.6	1003.2	#13 PENET	9-14-81
"	"	1548.7	1003.5	#14 PENET	9-14-81

SHOT	TOTAL CHG WT	INST TIME	INST VEL	COPPER PRESS	PULSE TIME 1+2	VEL 1+2	PULSE TIME 7+9	VEL 7+9	
#11	1980	582	5034	49100	166.1	4969	415.1	—	20 GR BLACK PWD
#12	1980	588	4983	50600	160.9	4966	413.8	—	20 GR BLACK PWD
#13	1980	584	5017	50000	162.4	4994	414.7	—	20 GR BLACK PWD
#14	1980	588	4983	49600	163.9	4981	414.5	—	20 GR BLACK PWD
#15	1980	585	5009	52100	167.7	4996	418.0	—	20 GR BLACK PWD
#16	1980	594	4924	46600	166.4	4910	414.4	—	20 GR BLACK PWD
#17	1980	588	4983	48000	163.8	4970	412.9	2000	20 GR BLACK PWD
#18	1980	592	4949	46600	173.8	4949	415.4	—	20 GR BLK PWD
#19	1980	575	5096	51700	171.2	5006	414.7	—	20 GR BLK PWD
#20	1980	565	5186	44500	170.8	5044	414.3	—	20 GR BLK POWDER
#21	1980	571	5131	42700	171.4	4973	414.5	—	20 GR BLK PWD
#22	1980	582	5034	47900	151.6	4968	413.4	—	20 GR BLK PWD
#23	1980	588	4983	50000	165.5	4982	411.4	—	20 GR BLK PWD
#24	1980	582	5034	46600	165.3	4993	411.4	—	20 GR BLK PWD
#25	1985	575	5099	50100	165.0	4996	411.9	—	20 GR BLK PWD

30mm FATCASE 15E1 20mm 14' SMOOTH BORE PROPELLANT WEIGHT		PKG WT GRAINS	PROJ WT GRAINS	BASE LINE 9.93 ÷ T	DATE
LOT [illegible] 15 0317 WEB [illegible] WEB	1200 GR [illegible]	15[illegible].1	[illegible].7	#15 PROJ	9-14-81
LOT [illegible]-15 0317 WEB LOT RAD-E30 0152 WEB	1200 GR 760 GR	1550.9	1002.2	#16 PROJECTILE	9-15-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1545.4	1002.5	#17 PROJECTILE	9-15-81
LOT [illegible]-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1545.9	1003.0	#18 PROJECTILE	9-15-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1547.9	1003.0	#19 PROJECTILE	9-15-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1546.7	1003.0	#20 PROJECTILE	9-16-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1534.5	1003.0	#21 PROJECTILE	9-16-81 *
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1546.9	1002.5	#22 PROJECTILE	9-29-81
LOT 693-15-0317 WEB LOT RADE30-0152 WEB	1200 GR 760 GR	1543.4	1002.7	#23 PROJECTILE	9-29-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1551.2	1003.0	#24 PROJECTILE	9-29-81
LOT 693-15 0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1546.1	1003.0	#25 PROJECTILE	9-29-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1553.3	1002.5	#26 PROJECTILE	9-30-81
LOT 693-15-0317 WEB LOT RAD E30-0152 WEB	1200 GR 760 GR	1542.5	1002.5	#27 PROJ	9-30-81
LOT 693-15-0317 WEB LOT RAD-E30-0152-WEB	1200 GR 760 GR	1535.0	1002.6	#28 PROJ	9-30-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1542.8	1002.5	#29	9-30-81
					*Sampler Replaced

SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	COPPER PRESSURE	PULSE TIME 1+2	VEL 1+2	PULSE TIME 7+9	VEL 7+9	PROPE
#26	1980	588	4983	48500	168.2	4957	411.2	—	20 GR BLACK PWD
#27	1985	587	4991	51700	160.3	4974	411.5	—	20 GR BLK PWD
#28	1985	586	5000	47000	165.2	4984	412.2	—	20 GR BLK PWD
#29	1985	587	4991	48700	164.5	4976	435.6	—	20 GR BLK PWD
#30	1985	586	5000	47600	163.8	5001	411.3	—	20 GR BLACK PWD
#31	1985	576	5087	47500	164.9	4981	410.1	—	20 GR BLACK PWD
#32	1985	587	5026	51800	164.6	5012	410.1	2055	20 GR BLACK PWD
#33	1985	645	4543	50400	162.8	5003	409.2	—	20 GR BLACK PWD
#34	1985	590	4966	48900	160.7	4955	409.5	—	20 GR BLACK PWD
#35	1985	583	5026	50400	149.8	4990	409.4	2007	20 GR BLACK PWD
#36	1985	586	5000	50400	170.8	4978	414.1	—	20 GR BLACK PWD
#37	1985	584	5017	50100	171.7	5029	416.4	—	20 GR BLACK PWD
#38	1985	592	4949	* 35400	172.9	4974	412.1	—	20 GR BLACK PWD
#39	1985	591	4958	47200	165.7	4949	412.4	—	20 GR BLACK PWD
#40	1965	588	4983	45100	168.1	4898	No READING		20 GR BLACK PWD

* PRESSURE HOLE NOT DRILLED PROPERLY.

30MM FAT CASE 15E1
20MM 14' SMOOTH BORE

BASELINE 2.93÷T

LOT	WEIGHT	PKG. WT. GRAINS	PROJECTILE WT./GRAINS	PROJECTILE NO.	DATE
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	154[illegible]	1002.7	30	10/1/81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1548.8	1002.7	31	10-1-81.
LOT [illegible] WEB LOT [illegible]-E30-0152 WEB	[illegible] 765 [illegible]	[illegible]	[illegible]2.7	32	[illegible]-1-81
LOT [illegible] WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1548.9	1002.[illegible]	33	10-1-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1549.1	1002.7	34	10-2-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1540.0	1003.0	35	10-2-81
LOT 693-15-0317 WEB LOT RAD E30-0152 WEB	1200 GR 765 GR	1538.0	1002.5	36	10-2-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1534.0	1003.0	37	10-5-81
LOT 693-15-0317 WEB LOT RAD E30-0152 WEB	1200 GR 765 GR	1548.1	1002.0	38	10-5-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1541.3	1003.7	39	10-5-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1544.5	1003.0	40	10-6-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1525.5	1003.0	41	10-6-81
LOT 693-15-0317 WEB LOT R[illegible]-E30-0152 WEB	1200 GR 765 GR	1541.0	1003.5	42	10-6-81
LOT 693-15-0317 WEB LOT RAD E30-0152 WEB	1200 GR 765 GR	1546.5	1003.0	43	10-6-81
LOT 693-15-0317 WEB LOT RAD E30-0152 WEB	1200 GR 765 GR	1545.6	1002.7	44	10-7-81

SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	COPPER PRESSURE	PULSE TIME 1+2	VEL 1+2	PULSE TIME 7+9	VEL 7+9	PROPELLANT
41	1985	586	5000	49900	161.6	4977	LOST		20 GR BLACK POWDER
42	1890	641	4570	27600	166.4	4586	212.4		20 GR BLACK POWDER
43	1985	LOST	LOST	46300	166.5	4946	211.3	—	20 GR BLACK POWDER
44	1945	626	4681	44900	166.6	4863	211.4	—	20 GR BLACK POWDER
45	1985	593	4950	51500	164.2	4993	212.7	—	20 GR BLACK POWDER
46	1985	616	4755	49360	LOST	* LOST	LOST	—	20 GR BLACK POWDER
47	1740	1062	2759	26500	162.3	4408	213.1	2708	20 GR BLACK POWDER
48	1985	586	5000	** 38300	161.7	5005	211.4	—	20 GR BLACK POWDER
49	1920	606	4835	42600	168.3	4814	LOST	NONE	20 GR BLACK POWDER
50	1985	595	4924	** 31100	168.3	4913	251.6	—	20 GR BLACK POWDER
51	1985	589	4975	47900	168.6	4961	211.4	—	20 GR BLACK POWDER
52	1890	618	4741	37500	163.2	4740	213.1		20 GR BLACK POWDER
53	1925	607	4827	34100	164.6	4842	211.0	—	20 GR BLACK POWDER
54	1980	593	4950	44400	167.5	4973	211.1		20 GR BLACK POWDER

* GUNNER ERROR - DID NOT WAIT FOR SIGNAL TO FIRE.
** PRESSURE HOLE IN CASE NOT DRILLED PROPERLY.

30MM FAT CASE 15E1 20MM 14' SMOOTH BORE AMT	GRAINS PKG WT	PKG WEIGHT	PROJECTILE WEIGHT GRAINS	BASELINE 2.93 ÷ T PROJECTILE #	DATE
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1546.7	1002.5	45	10-15-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1350 GR 520 GR	1546.3	1002.5	46	10-15-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1540.5	1002.5	47	10-16-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 715 GR	1550.2	1002.5	48	10-16-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1548.0	1002.5	49	10-16-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1543.8	1002.5	50	10-19-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 520 GR	1541.5	1002.7	51	10-19-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1541.2	1002.7	52	10-19-81
LOT [illegible]-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 700 GR	1544.4	1002.7	53	10-20-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1548.0	1003.5	54	10-20-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1540.5	1003.5	55	10-20-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 670 GR	1448.4	850.1	LENGTH 4.4" 56	10-28-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 705 GR	1447.4	850.6	LENGTH 4.4" 57	10-28-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 760 GR	1450.6	850.5	LENGTH 4.4" 58	10-28-81

SHOT NO.	TOTAL CHARGE WEIGHT	INST TIME	INST VEL	COPPER PRESSURE	TIME 1&2	VEL 1&2	PULSE TIME 7&9	VEL 7&9	PROJ
55	1985	599	4891	46800	178.3	4923	365.4	—	20 GR BLACK POWDER
56	1985	593	4941	48600	178.7	4924	365.2	—	20 GR BLACK POWDER
57	1985	586	5000	46100	173.3	4959	365.3	—	20 GR BLACK POWDER
58	1985	593	4941	46000	173.2	4964	365.5	—	20 GR BLACK POWDER
59	1985	603	4859	44800	161.1	4910	364.3	—	20 GR BLACK POWDER
60	1985	592	4949	48100	160.3	4976	364.6	—	20 GR BLACK POWDER
61	1985	594	4933	48300	159.8	4959	365.3	—	20 GR BLACK POWDER
62	1985	593	4941	35300	160.8	4954	366.0	—	20 GR BLACK POWDER
63	1985	594	4933	46000	166.7	4958	367.9	—	20 GR BLACK POWDER
64	1985	598	4900	47800	168.5	4953	369.6	—	20 GR BLACK POWDER
65	1985	589	4975	41700	165.9	4936	365.0	—	20 GR BLACK POWDER
66	1985	594	4933	51700	168.4	4964	365.3	—	20 GR BLACK POWDER
67	1800	652	4494	20100	168.7	4522	-	-	20 GR BLACK PWD
68	1850	635	4614	31600	170.1	4614	-	-	20 GR BLACK PWD

30MM FAT CASE 15E1 20MM 14' SMOOTH BORE ELLIPTICAL	BORE WEIGHT GRAINS	PKG WEIGHT IN GRAINS	PROJECTILE WEIGHT GRAINS	BASELINE 2.93 ÷T PROJECTILE #	DATE
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1541.9	1002.7	59	10-30-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1585.7	1002.7	60	10-30-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1543.3	1002.7	61	10-30-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1539.8	1002.8	62	10-30-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1538.7	1002.7	63	11-2-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1536.3	1002.7	64	11-2-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1541.2	1002.7	65	11-2-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1540.9	1003.0	66	11-2-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1540.8	1002.7	67	11-3-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1545.5	1002.5	68	11-3-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1530.0	1002.5	69	11-3-81
LOT 693-15-0317 WEB LOT RAD-E30-0152 WEB	1200 GR 765 GR	1544.8	1002.7	70	11-3-81
				TUNGSTEN	
LOT 693-15-029 WEB LOT RAD-E30-0152 WEB	1200 GR 600 GR	1441.8	913.0	3	1/7/82
LOT 693-15-029 WEB RAD-E30-0152 WEB	1200 GR 630 GR	1480.0	941.5	4	1/7/82

SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	COPPER PRESSURE	PULSE TIME 1+2	VEL 1+2	PULSE TIME 7+9	VEL 7+9	PROPELLANT
69	1850	638	4592	19300	163.9	4624	—	—	20 GR BLACK POWDER
70	1850	LOST	LOST	36700	161.5	4650	362.7	—	20 GR BLACK PWD
71	1850	638	4592	35800	159.2	4608	362.6	—	20 GR BLACK PWD

SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	COPPER PRESSURE	1+2 PULSE T	VEL	4+5 PULSE T	VEL	6+7 P.T.	VEL	8+9 P.T.	VEL
#1	1400	3556	872	34100	223.2	4300	72.6		83.1		84.0	
#2	1000	785	3392		3480	None	41.9	3311	40.3	3336	83.4	3327
#3	1150	641	4160		203.4	4098	42.0	4096	40.3	4090	83.8	4073
#4	1130	701	3804		166.7		83.7		82.3		83.5	

20 mm FAT CASE 15E1 20mm 14" SMOOTH BORE		PKG WT	PROJECTILE WT.	PROJECTILE NO.	BASELINE 2.93 ± T
	WT GRAINS	GRAINS	GRAINS	GRAINS	DATE
LOT 693-15-029 WEB LOT RAB E30-0152 WEB	1200 GR 630	1464.1	918.0	TEST SHOT	15 JAN 82
LOT 693-15-029 WEB LOT RAB E30-0152 WEB	1200 GR 630 GR	1448.3	906.5	Q1	15 JAN 82
LOT 693-15-029 WEB LOT RAB E30-0152 WEB	1200 GR 630 GR	1446.3	919.1	Q2	15 JAN 82
TYPE PROPELLANT	Pwdr WT GRAINS	PKG WT.	PROJECTILE WT.	PROJ. #	BASELINE 2.6T DATE
IMR 4996 LOT 45-030	1400 GR	1576.5	1007.0	#1	6 Oct 82 Test-Shots
"	1000 GR	1296.3	701.00	#2	7-Oct-82
"	1150 Gr.	1293.2	704.5	#3	8-Oct-82
IMR 4996 LOT - 45-030		1287.0	702.3	#4	15-Oct-82

APPENDIX L

UNEXPLODED ORDNANCE SURVEY BY SCIENTECH, INC.

ARDEC Picatinny Arsenal

Building 611B Characterization

Unexploded Ordinance Survey

Notes

1. This information describes the results of a survey done by Scientech, Inc. for identification of areas of the site which contain unexploded ordinance.

2. The material identified was flagged and personnel were instructed to prevent contact with the flagged devices.

3. All ordinance found inside the structure was removed and passed on to the ARDEC EOD group.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

SCIENTECH, INC.®
15 N. SKYLINE DRIVE ■ IDAHO FALLS, IDAHO 83402 ■ PHONE: 208-523-9552 ■ FAX: 208-523-9380

April 21, 1997

Mr. Tom O'Dou
Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Suite 580
Las Vegas, NV 89106

Subject: DCL-16-97: Inventory of recovered or identified Unexploded Ordnance and Ordnance and Explosives items at Picatinny Arsenal, New Jersey, April 14-18, 1997.

Dear Mr. O'Dou:

As per your request on April 17, 1997, the following list of items recovered or identified at building 611B is submitted.

7.62mm Armor Piercing Projectiles - (20)
50 Caliber Armor Piercing Projectiles - (34)
50 Caliber Primed Brass Cartridge Cases, - (5)
20mm Armor Piercing Incendiary Tracer (APIT) Projectiles - (111)
20mm Primed Brass Cartridge Cases, M103 - (62)
20mm Target Practice (TP) Projectiles - (156)
30mm Primed Brass Cartridge Cases, - (39)
30mm PGU-15B, Cartridges - (4)
Live Cartridge Primers - (6)
Smokeless Powder - (Less then 5 grams)
Tungsten Penetrators - (4)

The above items were removed from the existing buildings located on site 611B and turned over to the local Explosive Ordnance Disposal (EOD) team for disposition on April 17, 1997.

The following list of items were located and identified during the magnetometer sweep of the 611B site.

2.36" High Explosive Anti-Tank (HEAT) (Bazooka) - (9)
3.5" High Explosive Anti-Tank (HEAT) Rocket (1)
3.5" Practice Rocket (Dummy) - (1)
57mm High Explosive Recoilless Rifle Projectiles - (5)
57mm High Explosive Armor Piercing Recoilless Rifle Projectile (1)
75mm High Explosive Recoilless Rifle Projectile - (7)
60mm Mortar Rounds - (2)
Grenade, High Explosive Impact Percussion - (1)
Suspect Pipe Bomb (1)

The above items were reported to the local EOD at 1615 on April 17, 1997. They responded on the morning of April 18, 1997 and assumed responsibility for the disposition of all items.

Respectfully Submitted,

David C. Lindsey, Jr.
UXO/OE Project Manager

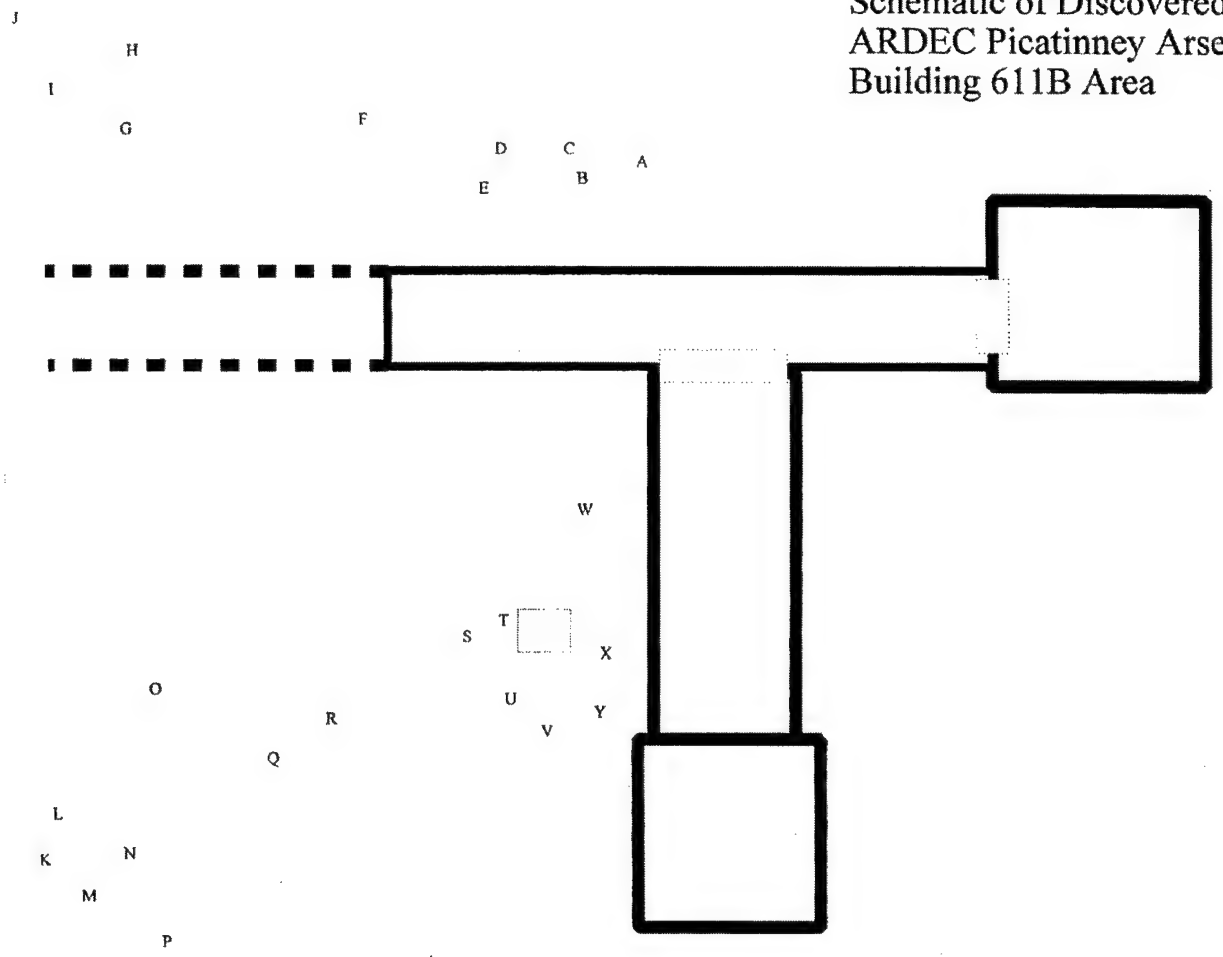
DCL:mr

Unexploded Ordinance Discovered at ARDEC Picatinny Arsenal Building 611B Area

Item Identified	Map Location
2.36" Rocket (HEAT) High Explosive Anti-Tank	A,C,D,H,O,Q,U,W,X
57mm Recoiless Rifle (RR) High Explosive (HX) Projectile	B,E,I,K
75mm RR HX Projectile	F,G,J,L,M,N,P,R
2" Pipe Bomb	O
60 mm mortar rounds	S,T
High Energy Fragmentation Hand Grenade	V
3.5" HEAT	Y

The survey which identified these items was completed by Scientech Inc. under contract to GPI.

Gutierrez-Palmenberg, Inc.
Schematic of Discovered Live Ordinance
ARDEC Picatinney Arsenal
Building 611B Area



APPENDIX M

REGULATION GUIDE 1.86, SECTION 5

U.S. ATOMIC ENERGY COMMISSION

June 1974

REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 1.86

TERMINATION OF OPERATING LICENSES FOR NUCLEAR REACTORS

A. INTRODUCTION

Section 50.51, "Duration of license, renewal," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that each license to operate a production and utilization facility be issued for a specified duration. Upon expiration of the specified period, the license may be either renewed or terminated by the Commission. Section 50.82, "Applications for termination of licenses," specifies the requirements that must be satisfied to terminate an operating license, including the requirement that the dismantlement of the facility and disposal of the component parts not be inimical to the common defense and security or to the health and safety of the public. This guide describes methods and procedures considered acceptable by the Regulatory staff for the termination of operating licenses for nuclear reactors. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

When a licensee decides to terminate his nuclear reactor operating license, he may, as a first step in the process, request that his operating license be amended to restrict him to possess but not operate the facility. The advantage to the licensee of converting to such a possession-only license is reduced surveillance requirements in that periodic surveillance of equipment important to the safety of reactor operation is no longer required. Once this possession-only license is issued, reactor operation is not permitted. Other activities related to cessation of operations such as unloading fuel from the reactor and placing it in storage (either onsite of offsite) may be continued.

A licensee having a possession-only license must retain, with the Part 50 license, authorization for special nuclear material (10 CFR Part 70, "Special Nuclear Material"), byproduct material (10 CFR Part 30, "Rules of General Applicability to Licensing of Byproduct Material"), and source material (10 CFR Part 40, "Licensing of Source Material"), until the fuel, radioactive components, and sources are removed from the facility. Appropriate administrative controls and facility requirements are imposed by the Part 50 license and the technical specifications to assure that proper surveillance is performed and that the reactor facility is maintained in a safe condition and not operated.

A possession-only license permits various options and procedures for decommissioning, such as mothballing, entombment, or dismantling. The requirements imposed depend on the option selected.

Section 50.82 provides that the licensee may dismantle and dispose of the component parts of a nuclear reactor in accordance with existing regulations. For research reactors and critical facilities, this has usually meant the disassembly of a reactor and its shipment offsite, sometimes to another appropriately licensed organization for further use. The site from which a reactor has been removed must be decontaminated, as necessary, and inspected by the Commission to determine whether unrestricted access can be approved. In the case of nuclear power reactors, dismantling has usually been accomplished by shipping fuel offsite, making the reactor inoperable, and disposing of some of the radioactive components.

Radioactive components may be either shipped offsite for burial at an authorized burial ground or secured

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USAEC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the AEC Regulatory staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Published guides will be revised periodically, as appropriate, to accommodate comments and to reflect new information or experience.

Copies of published guides may be obtained by request indicating the divisions desired to the U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Director of Regulatory Standards. Comments and suggestions for improvements in these guides are encouraged and should be sent to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Chief, Public Proceedings Staff.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust Review
10. General

on the site. Those radioactive materials remaining on the site must be isolated from the public by physical barriers or other means to prevent public access to hazardous levels of radiation. Surveillance is necessary to assure the long term integrity of the barriers. The amount of surveillance required depends upon (1) the potential hazard to the health and safety of the public from radioactive material remaining on the site and (2) the integrity of the physical barriers. Before areas may be released for unrestricted use, they must have been decontaminated or the radioactivity must have decayed to less than prescribed limits (Table I).

The hazard associated with the retired facility is evaluated by considering the amount and type of remaining contamination, the degree of confinement of the remaining radioactive materials, the physical security provided by the confinement, the susceptibility to release of radiation as a result of natural phenomena, and the duration of required surveillance.

C. REGULATORY POSITION

1 APPLICATION FOR A LICENSE TO POSSESS BUT NOT OPERATE (POSSESSION-ONLY LICENSE)

A request to amend an operating license to a possession-only license should be made to the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545. The request should include the following information

a. A description of the current status of the facility.

b. A description of measures that will be taken to prevent criticality or reactivity changes and to minimize releases of radioactivity from the facility.

c. Any proposed changes to the technical specifications that reflect the possession-only facility status and the necessary disassembly/retirement activities to be performed.

d. A safety analysis of both the activities to be accomplished and the proposed changes to the technical specifications

e. An inventory of actuvated materials and their location in the facility.

2. ALTERNATIVES FOR REACTOR RETIREMENT

Four alternatives for retirement of nuclear reactor facilities are considered acceptable by the Regulatory staff. These are:

a. **Mothballing.** Mothballing of a nuclear reactor facility consists of putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive fluids and waste should be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures should be established under a possession-only license to ensure that the health and safety of the public is not endangered.

b. **In-Place Entombment.** In-place entombment consists of sealing all the remaining highly radioactive or contaminated components (e.g., the pressure vessel and reactor internals) within a structure integral with the biological shield after having all fuel assemblies, radioactive fluids and wastes, and certain selected components shipped offsite. The structure should provide integrity over the period of time in which significant quantities (greater than Table I levels) of radioactivity remain with the material in the entombment. An appropriate and continuing surveillance program should be established under a possession-only license.

c. **Removal of Radioactive Components and Dismantling.** All fuel assemblies, radioactive fluids and waste, and other materials having activities above accepted unrestricted activity levels (Table I) should be removed from the site. The facility owner may then have unrestricted use of the site with no requirement for a license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of.

d. **Conversion to a New Nuclear System or a Fossil Fuel System.** This alternative, which applies only to nuclear power plants, utilizes the existing turbine system with a new steam supply system. The original nuclear steam supply system should be separated from the electric generating system and disposed of in accordance with one of the previous three retirement alternatives.

3. SURVEILLANCE AND SECURITY FOR THE RETIREMENT ALTERNATIVES WHOSE FINAL STATUS REQUIRES A POSSESSION-ONLY LICENSE

A facility which has been licensed under a possession-only license may contain a significant amount of radioactivity in the form of activated and contaminated hardware and structural materials. Surveillance and commensurate security should be provided to assure that the public health and safety are not endangered.

a. Physical security to prevent inadvertent exposure of personnel should be provided by multiple locked barriers. The presence of these barriers should make it extremely difficult for an unauthorized person to gain access to areas where radiation or contamination levels exceed those specified in Regulatory Position C.4. To prevent inadvertent exposure, radiation areas above 5 mR/hr, such as near the activated primary system of a power plant, should be appropriately marked and should not be accessible except by cutting of welded closures or the disassembly and removal of substantial structures

and/or shielding material. Means such as a remote-readout intrusion alarm system should be provided to indicate to designated personnel when a physical barrier is penetrated. Security personnel that provide access control to the facility may be used instead of the physical barriers and the intrusion alarm systems.

b. The physical barriers to unauthorized entrance into the facility, e.g., fences, buildings, welded doors, and access openings, should be inspected at least quarterly to assure that these barriers have not deteriorated and that locks and locking apparatus are intact.

c. A facility radiation survey should be performed at least quarterly to verify that no radioactive material is escaping or being transported through the containment barriers in the facility. Sampling should be done along the most probable path by which radioactive material such as that stored in the inner containment regions could be transported to the outer regions of the facility and ultimately to the environs.

d. An environmental radiation survey should be performed at least semiannually to verify that no signficant amounts of radiation have been released to the environment from the facility. Samples such as soil, vegetation, and water should be taken at locations for which statistical data has been established during reactor operations.

e. A site representative should be designated to be responsible for controlling authorized access into and movement within the facility.

f. Administrative procedures should be established for the notification and reporting of abnormal occurrences such as (1) the entrance of an unauthorized person or persons into the facility and (2) a significant change in the radiation or contamination levels in the facility or the offsite environment.

g. The following reports should be made:

(1) An annual report to the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545, describing the results of the environmental and facility radiation surveys, the status of the facility, and an evaluation of the performance of security and surveillance measures.

(2) An abnormal occurrence report to the Regulatory Operations Regional Office by telephone within 24 hours of discovery of an abnormal occurrence. The abnormal occurrence will also be reported in the annual report described in the preceding item.

h. Records or logs relative to the following items should be kept and retained until the license is terminated, after which they may be stored with other plant records:

(1) Environmental surveys,

(2) Facility radiation surveys,

(3) Inspections of the physical barriers, and

(4) Abnormal occurrences.

4. DECONTAMINATION FOR RELEASE FOR UNRESTRICTED USE

If it is desired to terminate a license and to eliminate any further surveillance requirements, the facility should be sufficiently decontaminated to prevent risk to the public health and safety. After the decontamination is satisfactorily accomplished and the site inspected by the Commission, the Commission may authorize the license to be terminated and the facility abandoned or released for unrestricted use. The licensee should perform the decontamination using the following guidelines:

a. The licensee should make a reasonable effort to eliminate residual contamination.

b. No covering should be applied to radioactive surfaces of equipment or structures by paint, plating, or other covering material until it is known that contamination levels (determined by a survey and documented) are below the limits specified in Table I. In addition, a reasonable effort should be made (and documented) to further minimize contamination prior to any such covering.

c. The radioactivity of the interior surfaces of pipes, drain lines, or ductwork should be determined by making measurements at all traps and other appropriate access points, provided contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement should be assumed to be contaminated in excess of the permissable radiation limits.

d. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated in excess of the limits specified. This may include, but is not limited to, special circumstances such as the transfer of premises to another licensed organization that will continue to work with radioactive materials. Requests for such authorization should provide:

(1) Detailed, specific information describing the premises, equipment, scrap, and radioactive contaminants and the nature, extent, and degree of residual surface contamination.

(2) A detailed health and safety analysis indicating that the residual amounts of materials on surface areas, together with other considerations such as the prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

e. Prior to release of the premises for unrestricted use, the licensee should make a comprehensive radiation survey establishing that contamination is within the limits specified in Table 1. A survey report should be filed with the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545, with a copy to the Director of the Regulatory Operations Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report should:

(1) Identify the premises;

(2) Show that reasonable effort has been made to reduce residual contamination to as low as practicable levels;

(3) Describe the scope of the survey and the general procedures followed; and

(4) State the finding of the survey in units specified in Table 1.

After review of the report, the Commission may inspect the facilities to confirm the survey prior to granting approval for abandonment.

5. REACTOR RETIREMENT PROCEDURES

As indicated in Regulatory Position C.2, several alternatives are acceptable for reactor facility retirement. If minor disassembly or "mothballing" is planned, this could be done by the existing operating and maintenance procedures under the license in effect. Any planned actions involving an unreviewed safety question or a change in the technical specifications should be reviewed and approved in accordance with the requirements of 10 CFR §50.59.

If major structural changes to radioactive components of the facility are planned, such as removal of the pressure vessel or major components of the primary system, a dismantlement plan including the information required by §50.82 should be submitted to the Commission. A dismantlement plan should be submitted for all the alternatives of Regulatory Position C.2 except mothballing. However, minor disassembly activities may still be performed in the absence of such a plan, provided they are permitted by existing operating and maintenance procedures. A dismantlement plan should include the following:

a. A description of the ultimate status of the facility

b. A description of the dismantling activities and the precautions to be taken.

c. A safety analysis of the dismantling activities including any effluents which may be released.

d. A safety analysis of the facility in its ultimate status.

Upon satisfactory review and approval of the dismantling plan, a dismantling order is issued by the Commission in accordance with §50.82. When dismantling is completed and the Commission has been notified by letter, the appropriate Regulatory Operations Regional Office inspects the facility and verifies completion in accordance with the dismantlement plan. If residual radiation levels do not exceed the values in Table I, the Commission may terminate the license. If these levels are exceeded, the licensee retains the possession-only license under which the dismantling activities have been conducted or, as an alternative, may make application to the State (if an Agreement State) for a byproduct materials license.

TABLE I

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE[a]	AVERAGE[b c]	MAXIMUM[b d]	REMOVABLE[b e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm β-γ/100 cm^2	15,000 dpm β-γ/100 cm^2	1000 dpm β-γ/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

APPENDIX N

PROJECT MANAGER'S LOG (O'DOU)

ARDEC Picatinny Arsenal

Building 611B Characterization

Project Manager Log

Notes

1. This information describes the daily coordination of work and any obstacles observed at building 611B.
2. This log has been provided to Joe Fabiano, Health Physicist at the site for information.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

Project Status Daily ARDEC - Picatinny Arsenal
Gutierrez-Palmenberg, Inc.

Day 1: Monday April 14, 1997

Completed book training of crew in the morning: six GPI employees:

Tom O'Dou	Dave Davis
Jimmy Maffessanti	JR Ruprecht
Ron Grosjean	Chuck White

At 1420 we arrived at the arsenal to visit with Mr. Fabiano regarding Safety, Police, Environmental, Chemistry, and Fire and emergencies. The meeting was canceled by Mr. Fabiano. However, Mr. Fabiano did meet with us to discuss the job and plans and most of what was expected to happen in the next few weeks, this meeting was very informative.

All but Chuck now have clearances. Chuck and Ron went to the airport to get the Scientech UXO contractors.

Day 2: Tuesday April 15, 1997

Met with Scientech people; went to site at 0630; got security clearances for them and Chuck.

We arrived at 611B at approximately 0700. After a brief tour of the facility to get everyone familiar with the safety needs there, Don Ebersole and Dave Lindsey from Scientech began their search for explosive devices in the 611B structure. Don and Dave found and removed several unfired primers in the instrument room and entryway into firing/target area.

By the end of this day we had all interior areas scanned and cleared for explosives, API projectiles were found in the storage area adjacent to the target room.

Radiological situation: There is not a serious radiological problem here. Any materials found with detectable activity have been segregated and will be stored in double bags in (nomenclature for the storage box). Items were found in the instrument room and in the closest storage area with count rates as high as 500 cpm on the Model 3 with a pancake probe.

Surveys were completed on materials in the instrument room, and the two storage areas. At this point I estimate that the instrument room is 30% clear, one storage area is 90% clear and the other is 50% clear. Characterization surveys have not been started, they will start when all unnecessary items and materials are removed from the facility.

Ray Siez, the building supervisor is providing support for the characterization by assisting in the removal of materials from the area after they have been cleared.

Day 3: Wednesday April 16, 1997

We arrived at the site at 0700 and began removal of clean materials for disposal in the dumpster at building 606. All disposed of materials were No Detectable Counts Above Background.

JR and Dave continued frisking in the instrument room. All electronics boxes showed no detectable counts above background.

Items found radioactive: One pair of gloves, a pair of shoes, the base structure for the electronics housing, and the drain lines from the sink in the instrumentation room.

Day 4: Thursday April 17, 1997

Arrived at the work site at 0700. It rained most of the day with a temperature of approximately 50 degrees. Continued work on clearing material from the building. Several items from the hallway including tools, cabinets, tyveks, rubber gloves, and boxes were found to have observable count rates above background. These items are now controlled as radioactive.

Mr. Fabiano and Mr. Styvaert visited the site and I gave Mike his copy of the work plan, health and safety plan and the quality assurance plan.

The base EOD crew (two sargents) arrived at 0830 to identify and contain the items found by the Scientech contractors Dave and Don. At approximately 0900 five more personnel arrived at the site, 4 military, 1 civilian. Several of the ordinance found were removed from the site, several more remain at the site and will have to be detonated in place. This should happen either Friday or Saturday.

Progress: The storage areas have been cleared (95%), the instrument room (90%), the foyer entrance to the firing areas (20%), the storage area in the building (35%). Gridding is complete for the outside survey.

Day 5: Friday April 18, 1997

We arrived at the site at 0700, Dave Lindsey and Don Ebersole left yesterday. Several unexploded ordinance remain at the site but the base EOD is now in charge of that material. It rained and then snowed at the site with the ambient temperature approximately 30 degrees.

We continued work on the instrument room then gridded most of the room for the characterization survey. I anticipate that we will complete gridding this room on Monday and complete it's characterization survey by Wednesday.

Work was also done on the DU range to clear as much of the miscellaneous instrumentation remaining in the area. This included tools used for pressing primers into place, large C clamps,

and the x-ray machine EM field monitors. Many of the items taken from the DU range have count rates of 100 to 50,000 cpm.

This room will provide the majority of radioactive waste generated. No radioactive material bags have been received. Radioactive items are being stored in heavy duty trash bags with radioactive material stickers. When we receive the materials we will re-bag the materials into more suitable bags.

Progress: The storage areas have been cleared (99%), the instrument room (95%), the foyer entrance to the firing areas (40%), the storage area in the building (35%). Gridding is complete for the outside survey. Outside work and work in the storage areas were not done today because of the weather.

Day 6: Saturday April 19, 1997

We didn't go to the site today, technicians completed survey forms.

Day 7: Sunday April 20, 1997

Bought 2 ladders and miscellaneous equipment for survey. Faxed time cards to Phoenix. Completed sample chain of custody forms, will ship samples this week.

Day 8: Monday April 21, 1997

Arrived at the site at 0700. Still no radioactive material bags.

Work completed on clearing material from the instrument room. This room has been completely gridded and some of the characterization surveys have been completed. The remainder of our surveys of this room will be complete tomorrow.

The entrance to the range areas were cleared today with most of the material released upon clearance survey. All materials found to be radioactive have been double bagged and labeled, logged into the tracking system and stored in the radioactive material storage area.

All wiring to pulsers and x-ray guns has been removed from the DU firing area and stored as radioactive waste. The x-ray guns have also been wrapped, removed from the area, and stored as radioactive. Some of these materials may be deconned and released during the remediation phase.

The target table and other miscellaneous materials have been packaged and removed from the target room. Will complete cleanup of the room tomorrow.

I met with Mr. Fabiano to discuss the project to this point and to get a briefing on operation of the Tennelec in the Health Physics lab. I will count smears in the lab tomorrow.

Day 9: Tuesday, April 22, 1997

Arrived at the site at 0700. Mr. Fabiano, IH and Safety called off their tour...may come tomorrow. We will continue on the characterization of the instrument room and cleanup of the non-DU range. Still no radioactive materials bags although this situation may be resolved in the next few days.

Jimmy continued characterization of the instrument room. Two areas were identified with fixed contamination on the wall (near where the sink was) and on the floor under where the sink was. This survey should be finished by tomorrow.

Dave, JR, and Chuck worked on cleanup and disassembly of equipment in the non-DU firing range hallway. Many pieces of equipment were found with the highest reading at 48 uR/hour on a target stand which was stored in the non-DU range. All radioactive materials found were packaged and as possible were stored in the storage area.

170 smears from the building were counted on the ARDEC Tennelec system. The highest removable activity was less than 50 picocuries. The system works great but cleaning the planchettes after counting is a chore. I priced planchettes at $320/1000 from Oxford the new owners of Tennelec.

I met with Mr. Fabiano regarding a memo that he wrote to describe the project to this point. I only have one significant comment, we must be more attentive to our contact when we have an appointment for a meeting. Be sure to call at least three hours in advance of any meetings with customers.

We received the letter from Scientech describing the ordinance found when we started the project. I put together a map from discussion with Don and Dave when they were here. This was given to Mr. Fabiano today.

Surveyed many items off the "open storage area" before coming across several metal pieces with contamination levels of up to 10,000 cpm. The contamination is fixed to the metal surface.

Progress: The storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (60%), the storage area in the building (35%), the DU firing range (40%), and the DU target room (20%). Gridding is complete for the outside survey, the entrance room and the instrument room. The instrument room characterization survey is 95% complete.

Day 10, Wednesday April 23, 1997

Arrived at the site at 0700. Upon arrival we noticed that a rodent had entered the count room and chewed up a filter that was prepared for the vacuum cleaner. The mess was then cleaned up.

We began to work primarily on the outside of the building focusing on the "outside storage area". Many pieces of steel (plates and items) were found to be contaminated in this area. Also, a box was found with significant contamination with evidence of a yellow flaking material in the bottom of the box. The count rate on this material was approximately 10,000 cpm. We controlled the material and followed the path of rain from the box and found fixed contamination above limits on the deck surface. Then the plywood section was removed from the deck and it was found that the material was also present in the cracks between the plywood. Some of this material was collected, bagged, and labeled. There is a lot of stuff under the open storage area floor, mostly wood. We had discussions with Mr. Fabiano about the activity found. I expect to meet with Mr. Fliszar, the base RPO in the morning.

At approximately 8:30 Mr. Fabiano, Ian Rosenblum (Chief of IH), and Pat Riley (Safety Specialist) came by to check out our operation. They toured the instrument room, non-DU firing room, DU firing room, DU target room and the exterior of the facility. Ian took some samples of the paint (to test for lead) and the floor tiles (to test for asbestos). The tour was satisfactory, no safety violations (or even recommendations for improvement).

During the characterization survey of the entryway, several tiles moved aside which caused increased count rates due to the collection of radioactive materials in the cracks between the tiles. It appears that most tiles in the typical walk path have this problem. The floor was not frequently washed and cannot simply be cleaned to remove the problem. A typical path of travel was surveyed and the instrument room floor, and outside on the pavement read greater than 1000 cpm. During the remediation this floor will have to be removed and decision made to find a suitable disposal site for that material.

With several outside sources found today, we have begun after several years of inoperation, to find the "hidden places" where contamination is present. The open storage area (gazebo) will generate more waste since it will need to be destroyed. The floor, pieces of beams under the floor, and any surface materials found to be contaminated.

At this point we have completed the 100% scan of the instrumentation room, all that remains is taking readings with the 2221 on all grids. We will train on the use of the 100 cm^2 probe during surveys of the grids. The initial survey for the building foyer is approximately 20% complete.

There has not been contact from EOD since last week. Several pieces of unexploded ordinance remain in the back yard.

Progress: The storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (80%), the storage area in the building (35%), the DU firing range (60%), and the DU target room (60%). Gridding is complete for the outside survey, the entrance room and the instrument room. The instrument room characterization survey is 98% complete, the survey for the foyer is approximately 20% complete. The open storage area has been cleared and survey is in progress.

Day 11: Thursday, April 24, 1997

Dixie Wells arrived last night and will be on-site today and tomorrow to audit our operations. Dixie may also be working in the count room to count smears and air samples.

Arrived at the site at 0700, continued removal of material from the non-DU tunnel. Activity was identified on several steel blocks in the end of the range. Several items were cleared and removed from the area.

The non-DU range was cleared of material by 1500 and gridding of the area was started. This area will be the main focus over the next few days in order to maximize the efficiency of the crew with Dixie Wells counting smears. By the end of the day, most of the gridding for this area was complete.

A spot was found when a rubber mat was moved from the non-DU entry way which caused a count rate of 20,000 cpm. The material was collected and controlled.

We are awaiting permission from the base IH (Ian Rosenblum) to remove the tile from several areas so that we can more accurately characterize the floor. All areas which were heavy traffic appear to have activity between the cracks greater than the limits.

More asbestos is suspected in the electrical wiring (very old stuff). Ian will be notified to collect samples of this as well.

The cap was removed from the UST pipe. A frisk of the inside of the pipe (on the threads) caused a net count rate of greater than 100 cpm. The frisker was then lowered into the pipe and at the full length of the cable the count rate was greater than 100 cpm. We lowered a weighted string into the tank and found that the bottom of the tank was approximately 7.5 feet below the top of the tank fill pipe. The water level in the tank is approximately 3 inches.

Ron and Dixie worked in the counting lab.

Still no radioactive material bags and no tags!

Progress: The storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (100%), the storage area in the building (35%), the DU firing range

(60%), and the DU target room (60%). The instrument room characterization survey is 98% complete, the survey for the foyer is approximately 90% complete. The open storage area has been cleared of material and the survey revealed several spots greater than 100 net cpm. Some spots were found in excess of 300 cpm.

Day 12, Friday, April 25, 1997

We arrived at the site at 0700. The primary focus for today will be gridding and survey of the non-DU range.

Gridding and smearing of the non-DU hallway was completed. This represents a significant effort and a large number of smears were collected - these are being counted by Dixie Wells.

Ian (IH) showed up and collected samples of the old wiring found on the heaters for asbestos. Also, Ian indicated that he sent an e-mail to Joe about us being able to remove the vinyl tile from the floor to assist our characterization.

Ron worked on clearing material from the storage area at the end of the DU tunnel. Most materials have now been cleared from the room and it has been vacuumed.

At the current time radioactive materials removed from the facility will fill about two B-25 boxes. This represents approximately 250 cubic feet of waste. Also, approximately 20 cubic yards (540 cubic feet) of material have been removed from the site and cleared. It is estimated that a maximum of four B-25 boxes could hold all of the waste from the remediation.

A brief survey of the HEPA system externals revealed fixed activity on the base of the system with count rates up to 500 cpm. The sealant which was used on some of the system components has count rates up to 300 cpm. We were told there were two fires in the system over the history of the site.

We got permission from the State of NJ to use LAS labs for the analysis of the soil samples as planned. All samples at the site have been taken except the background samples and boxed for shipment, we expect to do this on Monday.

Progress: The external (mobile) storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (100%), the storage area in the building (95%), the DU firing range (60%), and the DU target room (60%). The instrument room characterization survey is 99% complete, the survey for the foyer is approximately 100% complete. The open storage area has been cleared of material and the survey revealed several spots greater than 100 net cpm, the area has been posted with caution tape and several pieces of plywood lifted from the floor. Some spots were found in excess of 300 net cpm. The characterization grids for the non-DU range are complete and smears of the non-DU range have been taken.

Day 13, Monday, April 28, 1997

We arrived at the site at 0700. A rainy day, relatively cold. Dave was sick today, we worked inside with our little heater warming the area. We continued to focus on the non-DU tunnel. We are approaching 30% on this.

I completed a scoping survey of the DU target room. This included GM probe evaluation, smears, and gamma scintillation detector response from all of the room's surfaces. The 100 cm^2 scintillator response remains here but with the extensive GM evaluation, only 2 readings per grid need to be evaluated.

Rich Fliszar showed up at the site in the afternoon. He toured the facility and I briefed him on the current status of the project. He had no comments on the tour I am sure this means that all is fine. Rich will be out of town till next Thursday. Andy will be acting in his place. Joe remains as our primary contact.

Dixie counted smears in the HP lab. We have completed smears for the non-DU tunnel, Instrument room, foyer, and smears for the DU target room were taken today. The DU tunnel will be gridded tomorrow to facilitate using Dixie to our full advantage. She will be here till Thursday.

After all of the smear surveys are complete, we will complete the inside characterization, then outside, then the HEPA storage area.

Day 14: Tuesday, April 29, 1997

Here's the latest score and how to keep track of things:

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	0%
Non-DU Tunnel	100%	100%	50%	100%	20%
DU Tunnel	100%	100%	0%	100%	0%
Inside Storage	95%	100%	0%	100%	0%
Open Storage	100%	100%	10%	0%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%

It was a nice day after the freezing cold morning. Temperatures actually may have exceeded 70 degrees (21 degrees C) and we could take off our coats. We all miss home.

The work focused on completion of all smears so that we could ensure that the counting lab was not needed any more. This was achieved.

After lunch the crew focused on paperwork to try to get caught up on surveys. Jimmy continued with 100 cm^2 readings with the 2221. The rough surfaces on the walls have made some small holes in the mylar, the problem was temporarily corrected with white-out.

Dixie analyzed the smears from the target room and found loose surface activity up to 30,000 dpm. This was expected to be high but not as high as reported. The remainder of the smears collected for the project have been passed to Dixie for counting.

I met with Joe at 12:20 to discuss the project thus far and to resolve some of the support issues needed to ensure success of the project. These included:

1) Meeting with the base EOD Sargent (Smith) who said they will not be removing any more materials from the site and we should stay away from flagged items when we do our work. Any further removal of EOD would require that the base get a contractor to clear the area on and under the surface. This would require that we leave until this could be done.

2) The list of materials that have been cleared thus far was faxed to Mr. Clune for removal of the items from the site. We will get a call just before they come to the site.

3) I met with Ted Gable, the environmental person in charge of reports. They would like us to follow their standard report format for characterization. I explained that I would attempt to keep to their format as much as practical but that my contract specifications did not include a report format and I must keep to a project schedule and cost.

In addition, we reviewed the report that was written last week for my concurrence with the status of the project. This was really to bring Joe up to speed on how we are doing. The following items were discussed:

1) Lab security and sound control.
2) We got our Rad bags (finally).
3) Details of the Daily Status report (this log).
4) Site safety.
5) Penetration to the area beyond the target room to seek a wayward bullet?

We purchased some more supplies, rubber gloves, duct tape, and markers.

At this point I can say that the degree of contamination is higher than expected and the degree of poor weather makes me want to retire to LV.

Tomorrow we will continue to focus on the 100 cm^2 survey of the non-DU range and frisking of the DU range.

Day 15: Wednesday, April 30, 1997

Once again, here's the latest score and how to keep track of things:

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	0%
Non-DU Tunnel	100%	100%	50%	100%	20%
DU Tunnel	100%	100%	50%	100%	0%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%

It was a nice day today. Temperatures exceeded 70 degrees.

The crew focused on paperwork to try to get caught up on surveys. Jimmy continued with 100 cm^2 readings with the 2221. Dave continued working on the DU hallway and made a major dent in the frisking of those surfaces.

Dixie analyzed the remainder of the smears from all areas. All smears have been completed.

People showed up to move the clean material from the site. Most of the clean storage area was emptied, they will be back to get more when we get our surveys to Mr. Fabiano.

Tomorrow we will continue to focus on the 100 cm^2 survey of the non-DU range and frisking of the DU range.

Day 16: Thursday, May 1, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	0%
Non-DU Tunnel	100%	100%	60%	100%	30%
DU Tunnel	100%	100%	70%	100%	0%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	0%	0%	0%	0%	0%

It rained and was cold today. The perdiem checks for next week have been passed out and the expense reports signed.

The crew continued to focus on paperwork. Jimmy continued with 100 cm^2 readings with the 2221. Dave continued working on the DU hallway.

People showed up to move the clean material from the site. The clean storage area is now cleared out and the metal target plates have been removed from the site. A dumpster was left on site for our use.

The 100 cm^2 survey of the DU target room is complete. This completes the characterization of this room.

Tomorrow we will continue to focus on the 100 cm^2 survey of the non-DU range and frisking of the DU range.

Day 17: Friday, May 2, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	50%
Non-DU Tunnel	100%	100%	70%	100%	35%
DU Tunnel	100%	100%	70%	100%	20%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	(1)	0%	0%	0%	0%

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was cold today.

The crew continued to focus on paperwork. Jimmy and I continued with 100 cm^2 readings with the 2224 and 2221. Ron continued working on the non-DU hallway.

It's the week end!

Day 18: Monday, May 5, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	100%
Non-DU Tunnel	100%	100%	90%	100%	45%
DU Tunnel	100%	100%	80%	100%	40%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	10%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	(1)	NA	0%	0%	NA

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was a decent day for New Jersey.

The focus today was completion of paperwork and continue to plug away at the characterization readings. Documentation is complete for the last surveys.

We continued to work on frisk surveys and final survey for the DU and non-DU tunnels. This is taking the most time right now because of the higher amount of activity found than was indicated to be present.

We began detailed surveys of the open storage area to more accurately determine it's status. At the current time it looks like there is activity present on the open storage area structure (floor).

Since the structure of the open storage area is above fixed contamination limits, 10000 dpm/100 cm^2, the area around the open storage area must be surveyed as potentially affected, the base of wood should either be removed or covered and posted. I'm leaning toward removal of the floor and determination of what is under the floor of this structure. If tomorrow is a good day, we will probably focus outside.

Day 19: Tuesday, May 6, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	100%
Non-DU Tunnel	100%	100%	90%	100%	60%
DU Tunnel	100%	100%	80%	100%	60%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	60%	100%	70%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	(1)	NA	0%	0%	NA

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was a disgusting day even for New Jersey, mostly rain and cold.

We continued to work on frisk surveys and final survey for the DU and non-DU tunnels. This is continues to take the most time.

Survey packages are beginning to come together for most areas.

We completed most of the grids outside on the open storage area, and posted the area for radioactive materials.

Day 20: Wednesday, May 7, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	90%	100%	80%	>1000 cpm
DU Tunnel	100%	100%	80%	100%	70%	>10000 cpm
Inside Storage	100%	100%	60%	100%	0%	>500 cpm
Open Storage	100%	100%	100%	100%	70%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	0%	NDA
Mobile Storage #2	100%	100%	100%	100%	0%	NDA
Outside Grounds	NA	50%	NA	NA	0%	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	0%	0%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was a cold and windy day but at least it wasn't raining. We focused on the outside work in anticipation of rain for the remainder of the week.

We continued to work on frisk surveys and final survey for the DU and non-DU tunnels.

Mr. Fabiano came to the work site for a tour around the facility during our work, no comments were provided. I also went to Mr. Fabiano's office to discuss the project log and some questions I had about control of the wood surface on the open storage area. We will recommend some type of semi-permanent control of the material such as painting the wood surface.

Day 21: Thursday, May 8, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	100%	100%	85%	>1000 cpm
DU Tunnel	100%	100%	85%	100%	80%	>10000 cpm
Inside Storage	100%	100%	100%	100%	40%	>500 cpm
Open Storage	100%	100%	100%	100%	70%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	0%	NDA (2)
Mobile Storage #2	100%	100%	100%	100%	0%	NDA
Outside Grounds	NA	50%	NA	NA	0%	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	100%	100%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

(2) NDA = No Detectable Activity, upon investigation there was no response of field instruments to these areas and laboratory instruments found no evidence of activity.

It was a nicer day and again it didn't rain. Continued frisking and large probe surveys.

The Open Storage Area surface where fixed contamination caused as much as 8000 cpm on the 100 cm2 probe was sealed by painting with a latex covering. This will seal the activity from migration during the time between this characterization and remediation of the site.

The HEPA system was surveyed in depth today, some smearable activity was identified outside of the filter bank, this approaches the limits for surface contamination and indicates that activity has been released from this system by improper operation or by improper removal of filters or both. Only one filter was found in the system and the last stage filter has collected activity over the years of operation or as a result of the destruction of the fist two stages in a fire. A smear at the outlet of the system indicates the presence of activity above background. This system is contained somewhat but personnel access to these spaces should be restricted.

Day 22: Friday, May 9, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	100%	100%	100%	>1000 cpm
DU Tunnel	100%	100%	100%	100%	80%	>10000 cpm
Inside Storage	100%	100%	100%	100%	40%	>500 cpm
Open Storage	100%	100%	100%	100%	100%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	100%	NDA (2)
Mobile Storage #2	100%	100%	100%	100%	0%	NDA
Outside Grounds	NA	100%	NA	NA	NA	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	100%	100%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

(2) NDA = No Detectable Activity, upon investigation there was no response of field instruments to these areas and laboratory instruments found no evidence of activity.

It rained again a cold wet breeze. We continued the survey of the inside storage area and various small surveys throughout the building. We received the employee manuals and the mylar windows, thanks.

Mr. Fabiano visited the site early today to review our progress and deliver the latest weekly report he prepares.

I spoke with Mike Styvaert, Rich Fliszar and Joe Fabiano yesterday. As a result of those conversations, we can keep our original copy of the counting data and the open storage area could be sealed with latex to prevent erosion of the activity from the wooden surface.

Documentation once again received a lot of attention. A lot of time was spent on organization of the data collected, all data to this point has been tracked and is filed by survey serial number.

Day 23: Monday, May 12, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	100%	100%	100%	>1000 cpm
DU Tunnel	100%	100%	100%	100%	100%	>10000 cpm
Inside Storage	100%	100%	100%	100%	100%	>500 cpm
Open Storage	100%	100%	100%	100%	100%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	100%	NDA (2)
Mobile Storage #2	100%	100%	100%	100%	NA (3)	NDA
Outside Grounds	NA	100%	NA	NA	NA	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	100%	100%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

(2) NDA = No Detectable Activity, upon investigation there was no response of field instruments to these areas and laboratory instruments found no evidence of activity.

(3) Mobile storage area #2 is used as a Radioactive Material Storage Area and a final release survey will not be done until after the remediation of the facility.

It was a beautiful day today, the sun shined through the clouds and it did not rain.

We continued the survey of the inside storage area and various small surveys throughout the building.

Mr. Eric Reber from the NRC visited the site today to conduct an inspection of our work in accordance with the guidelines of our work plan, H&S plan, etc. No violations were cited and no recommendations for improvement were even suggested by the inspector.

We are preparing to package everything and leave the site tomorrow.

Day 24: Tuesday, May 13, 1997

We arrived on site at the usual time, 0700 and packaged all material for shipment.

All surveys are now complete, and the materials which were released from the site have been taken to building 7 as directed by Mr. Fabiano.

We cleaned up the outside and inside of the structure preparing things to be secure until the remediation.. We met with Mr. Fabiano to discuss the project and our activities while we were on site.

Storage box number 2 is the designated radioactive material storage area and will remain on-site until removal of all material.

APPENDIX O

NRC LICENSE AND NRC CORRESPONDENCE

ARDEC Picatinny Arsenal

Building 611 B Characterization

NRC License and Correspondence

Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Las Vegas, NV 89106
702-647-5699

Gutierrez - Palmenberg, Inc.

333 North Rancho Drive, Suite 580
Las Vegas, Nevada 89106

April 11, 1997

Joe Fabiano
ARDEC
AMSTA-AR-QAS-R, Bldg 320
Picatinny, NJ 07806-5000

Dear Mr. Fabiano,

Based on your conversation with Thomas O'Dou, PM for the ARDEC characterization, this AM, I will attempt to respond to your concerns with regard to the Picatinny Arsenal-ARDEC Work Package.

The Work Package was submitted to the Walnut Creek Field Office of Region IV with a cover letter dated March 20, 1997. In accordance with License Condition 13 of NRC License # 29-27103-01, it was submitted at least two (2) weeks prior to the expected start date of the project. Both Mr. O'Dou and myself have discussed the Work Package with the Region IV NRC point of contact since that time.

I can, therefore, assure you that the complete Work Package has been received and is on file with the NRC in that office. I have talked to our NRC contact and you are free to call Ms. Beth Prange at 1-510-975-0250 if you have any further questions regarding our license or the submittal of the Work Package to them.

If you have any other questions or concerns, please call me at the Las Vegas office at 1-702-647-5699.

Thank you.

Dixie J. Wells
Radiation Safety Officer
GPI-Las Vegas

cc: Thomas O'Dou, PM
Walter Cunningham, VP
Beth Prange, NRC Region IV
File

NRC FORM 374
(7-94)

U.S. NUCLEAR REGULATORY COMMISSION

PAGE 1 OF 5 PAGES

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Gutierrez-Palmenberg, Inc.	3. License Number 27-29103-01
2. 333 North Rancho Drive, Suite 580 Las Vegas, Nevada 89106	4. Expiration Date December 31, 2001
	5. Docket or Reference No. 030-34257

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License
A. Any byproduct material with Atomic Nos. 1 through 83	A. Any	A. 100 curies
B. Any byproduct material with Atomic Nos. 84 through 103	B. Any	B. 1 curie
C. Any source material	C. Any	C. 10,000 kilograms
D. Any special nuclear material	D. Any	D. 350 grams uranium 235, or 200 grams plutonium, or 200 grams uranium 233, or any combination of these provided the sum of the ratios of the quantities does not exceed unity

9. Authorized use

A. through D. For receipt, storage, use and or possession incidental to any activity as follows:

(1) Decontamination of facilities, equipment and containers;
(2) Solidification and treatment of wastes;
(3) Packaging for transport;
(4) Any activity related to site characterization; and
(5) Transport in packages or containers approved for use under the provisions of 10 CFR 71, for transfer to licensees authorized to receive the materials, in accordance with the terms and conditions of licenses issued by the NRC or an Agreement State.

CONDITIONS

10. Licensed materials shall be used only at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material. Except for calibration sources, reference standards, and radioactively contaminated equipment owned by the licensee, possession of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site after licensee activities are completed.

11. A. Licensed material shall be used by, or under the supervision of, individuals designated in writing by the Radiation Safety Committee, Thomas J. O'Dou, Chairperson.

B. The Radiation Safety Officer for this license is Dixie J. Wells.

12. In addition to the possession limits in Item 8, the licensee shall further restrict the possession of licensed material to quantities below the limits specified in 10 CFR 30.72 which require consideration of the need for an emergency plan for responding to a release of licensed material.

13. The licensee shall notify the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011, ATTN: Director, Division of Nuclear Material Safety, in writing at least 14 days before initiating activities under this license at a temporary job site. This notification shall include:

A. The estimated type, quantity, and physical/chemical forms of licensed material to be used
B. The specific site location
C. A description of planned activities including waste management and disposition
D. The estimated start date and completion date for the job, and
E. The name and title of a point of contact for the job, including information on how to contact the individual.

14. This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by a customer's license. If a customer also holds a license issued by the NRC or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensee activities shall be performed under the customer's license and supervision,

14. (Continued)

and which licensee activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall include a commitment by the licensee and the customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of this agreement shall be included in the notification required by License Condition 13.

15. The licensee shall maintain records of information important to decommissioning each temporary job site at the applicable job site pursuant to 10 CFR 30.35(g), 40.36(f), and 70.25(g). The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.

16. Pursuant to 10 CFR 30.11, 40.14, and License Condition 10., the licensee is exempted from the requirements of 10 CFR 30.35, 40.36, and 70.25 to establish decommissioning financial assurance.

17. If approved by a Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when the action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the NRC before, if practicable, and in any case immediately after taking such emergency action using the reporting procedure specified in 10 CFR 30.50(c).

18. Within 30 days of completing activities at each job site location, the licensee shall notify the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011, ATTN: Director, Division of Nuclear Material Safety, in writing of the temporary job site status and the disposition of any licensed material used.

19. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

20. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as specified by the certificate of registration referred to in 10 CFR 32.210.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

20. (Continued)

C. In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

D. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.

E. Sealed sources need not be leak tested if:

(i) they contain only hydrogen-3; or

(ii) they contain only a radioactive gas; or

(iii) the half-life of the isotope is 30 days or less; or

(iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

(v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

F. The leak test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(b)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011, ATTN: Director, Division of Nuclear Materials Safety. The report shall specify the source involved, the test results, and corrective action taken.

G. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to perform such services.

21. The licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under the license.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
27-29103-01

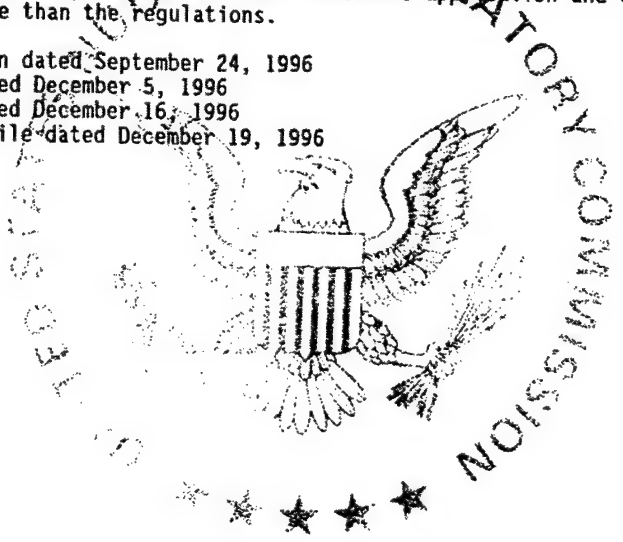
Docket or Reference Number
030-34257

22. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

23. This license does not authorize the import of byproduct material wastes.

24. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated September 24, 1996
B. Letter dated December 5, 1996
C. Letter dated December 16, 1996
D. Telefacsimile dated December 19, 1996



FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date DEC 19 1996

By _____
Materials Branch
Region IV, WCFO
Walnut Creek, California 94596

APPENDIX P

RADIATION WORK PERMITS (GPI AND ARDEC)

ARDEC Picatinny Arsenal

Building 611B Characterization

Radiation Work Permits

Notes

1. This information describes the requirments imposed by GPI and ARDEC - Picatinny Arsenal on the site work.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

RADIATION WORK PERMIT w SUPPLEMENT No. 97-7
(for operations not covered by SOP)

PART I. Request for Work Permit (triplicate)

Type of Radiation: Alpha, Beta, Gamma

Location: Building Number 611B and Associated Structures and Grounds Date: 11 April 1997

Description of Operation: HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

Name	TLD#	Exposure Dose (R)	Name	TLD#	Exposure Dose (R)
See Supplement					

Printed Name and Title of Supervisor	Signature of Supervisor
Jimmy Maffessanti, Project Supervisor	

PART II. Radiation Protection Officer (RPO) Approval/Disapproval

☒ Approved ☐ Disapproved The RPO will be notified prior to commencement and upon termination of operation. Protective Clothing and Equipment Requirements, and Special Instructions are:

	Protective Clothing and Equipment PER GPI HEA & SAF PLAN							
	Coveralls		Pants		Safety shoes		Eye protection	
	Lab coats		Gloves		Shoe covers		Ear protection	
	Other				Respirator		Head covering	
	Special Instructions SEE SUPPLEMENT							
X	Personnel monitoring required before leaving area.							
X	Tool monitoring required at completion of work.							
X	No cuts or abrasions permitted on hands or forearms.							
X	~~Air monitoring: Breathing Zone~~			~~Personal~~		~~General~~		~~Process~~
X	*Personnel Dosimetry: Whole Body	X	Hand & fingers					

IAW GPI PROC

*ARDEC

Date: 4-14-97 Signature of RPO: _____

PART III: Work Termination Statement

☐ Request RWP be extended to _____.
☐ Work was completed on _____.

Date: _____ Signature of Supervisor: _____

PART IV: RPO Review

☐ Area has been decontaminated to appropriate levels.
☐ No internal radiation exposures >5% MPD.
☐ Comments: _____

Date: _____ Signature of RPO: _____

SMCAR-SE FORM 1607, 1 NOV 93

SUPPLEMENT TO RADIATION WORK PERMIT NUMBER 97-7

HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

1. Prerequisites and Precautions:

a. ARDEC Radiation Work Permit (RWP) approved and conspicuously posted at the site. All radiological work shall be controlled through the implementation of this Radiological Work Permit.

b. Feedback information meetings will be held weekly between the Radiation Protection Office and GPI to discuss the previous weeks findings.

c. Characterization of DU contamination at the 611B site will be done under Guttierrez - Palmenberg, Inc. US NRC license Number 27-29103-01, Reference No. 030-34257.

d. Radiological controls will be in effect for all work within Radiologically Controlled Work Zones.

e. All project personnel will understand and comply with the contents of the ARDEC RWP and Updated GPI Characterization Work Plan , Quality Assurance Plan and Health and Safety Plan.

f. No matches, lighters or cameras within the enclosure without special permission.

g. No smoking, eating, drinking in controlled radiation areas.

h. All emergency calls are to be directed to 201 724 6666.

i. GPI will sweep for Unexploded surface and subsurface Ordnance around Building 611B evaluating and identifying "ring offs" prior to characterization.

j. Pre and Post Depleted Uranium Bioassays are required. Specimens and confirmatory samples must be sent to a New Jersey Certified Laboratory such as Teledyne Isotopes., Westwood, NJ.

k. Personnel protective equipment or engineering devices must be used to protect individuals and clothing from radioactive contamination during characterization efforts.

l. ARDEC issued dosimeters are to be worn in all radiologically controlled areas including the Health Physics laboratories in Building 320 by crew and visitors.

m. Portable instruments must have current calibration labels such as for the Model 3 with Model 44-9 pancake G-M probe and 44-X (100sqcm beta scintillator probe) for beta and gamma detection, the Ludlum Model 19 (micro R-meter) (Sodium Iodide detector) for gamma and x-ray detection, and the Ludlum 2224 or 2221 countrate meter/scaler (100sqcm alpha/beta scintillation probes) for beta emissions from large surfaces.

n. Low Volume Air Samplers will be used for ambient air samples, HEPA vacuum for removing loose dust, concrete chips, etc. magnetic locator from the Shonstendt Instrument Company for detecting unexploded ordnance.

o. Sampling grids will be constructed/established for each affected area in accordance with NUREG/CR-5849 and guidance from the Industrial Operations Command such as 1 m grids inside known areas of contamination, 3 m grids in adjacent areas and 10m grids on the outskirts of the facility.

SUPPLEMENT TO RADIATION WORK PERMIT NUMBER 97-7 CONTINUED

HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

p. Electrical, water, and telephone utilities servicing the building will be located, verified, and isolated by GPI.

q. GPI is to supply planchets and cloth smears for collecting samples especially over rough surfaces.

r. Under no circumstances will radioactively contaminated items be free released from any work location. Tools, equipment, etc. will be frisked prior to release.

s. Bottoms of shoes and hands will be frisked upon leaving the radiologically controlled areas and the laboratories in Building Number 320.

t. Soil remediation levels for Depleted Uranium are to be in accordance with the New Jersey Department of Environmental Protection Agency for unrestricted, non-residentail (industrial) use i.e. 35 pCi/g above background and consistent with NRC requirements

u. Practice good personal hygiene and wash hands after activities involving radiological work.

v. GPI should avoid conducting outdoor radiological activities during inclement weather.

w. GPI will carry swipes in strong, tight, appropriately lined/labeled carrying cases, load smear samples onto planchets/carriers/equipment, unload and dispose of planchets/swipes using good health physics practices.

x. Copies of reports, records or correspondence will be maintained at a location on post selected by GPI for review by government agencies.

y. All GPI postings, materials and equipment will be removed from the "clean" areas and the grounds left in swept/raked condition at the completion of work.

z. No deviations from this permit are permitted without the approval of the ARDEC Radiation Protection Office.

2. Personnel identified below shall participate in the Phase I Characterization of Building Number 611B and associated grounds.

a. Tom O'Dou (Certified Health Physicist, Project Manager, PM)
b. Jimmy Maffessanti (Project Supervisor, PS)
c. J.R. Ruprecht (Senior Technician, RPS)
d. Dave Davis (Senior Technician)
e. Chuck White (Senior Technician)
f. Ron Grosjean (Junior Technician)
g. Tony Mason (Senior Health Physicist)
h. Dixie Wells (Radiation Safety Officer)
i. Roger Palmenberg (GPI Vice President)
j. Gilbert Gutierrezz (GPI President)
k. David Lindsey (UXO expert)
l. Donald Ebersole (UXO expert)

SUPPLEMENT TO RADIATION WORK PERMIT NUMBER 97-7

HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

3. This permit authorizes:

a. Pre-work receipt of supplies and setting up a work area.

b. Signing out the keys from the Radiation Protection Office for Bldg. No. 611B, the storage room, and outside shelters and returning them at the end of Phase I to the Radiation Protection Office.

c. Sweeping areas for unexploded ordnance.

d. Setting up a grid system

e. Segregating contaminated from non-contaminated items for processing.

f. Characterizing the 611B site, including the mound of dirt behind the target room storage area and the underground storage tank.

g. Utilizing the Health Physics Laboratory Gas Flow Proportional Counter in Building Number 320 for counting swipe samples and air samples.

h. Use of facilities and office supplies in Buildings Numbered 320, 617 and/or 7 on an "as needed" basis.

i. Gathering the data required for developing a decommissioning plan.

5. The POC for this action is the undersigned.

JOSEPH A. FABIANO
HEALTH PHYSICIST
14 APRIL 1997

Gutierrez-Palmenberg, Inc.

Las Vegas, NV & Phoenix, AZ

RADIOLOGICAL WORK PERMIT

RSO USE ONLY	
Permit Number	AR-1
Effective Date: 4/01/1997	Expiration Date: 5/25/1997

GENERAL INFORMATION (to be completed by the requester)

Requested by	Request Number	ID Number	Group	Phone No.	Mail Stop
Thomas J. O'Dou	3	AR-1	PM	7-5699	580

Work Location	Technical Area	Building	Substructure	Room No.
ARDEC - Picatinny Arsenal	SEC	611B	In And Out	All

SOP Number	Small Job Ticket No.	Work Order No.	Requested Start Date	Expected End Date
WORK PLAN	H&S PLAN		4/15/1997	5/16/1997

Work to be performed *(add attachment if necessary)* ☒ RSO review is needed ☐ RSO review is attached

Characterize building 611B and grounds for DU contamination resulting from firing DU rounds inside the building 611B firing range into the target room. Areas of primary concern for contamination control are:

1) The target room
2) The firing room
3) The HEPA ventilation system

Contamination controls shall be used for sampling of the UST outside building 611B. The sink and piping in the instrumentation room shall be considered potentially contaminated prior to removal.

PRE-JOB RADIOLOGICAL CONDITIONS (to be completed by the RCT/HPT

☒ Anticipated radiological conditions *(Enter anticipated conditions if a survey cannot be performed before work begins).* or

☐ Measured radiological conditions *(Record all readings as highest / general area.)* ☐ See attached map

Surface Contamination (dpm/100 sq cm)

	Direct	Smear	LAS (large area swipe)
Alpha	ND	ND	ND
Beta/gamma	10000	1200	ND
Tritium		ND	

External Dose Rate (mrem/hr in work area)

Beta + gamma	.1
Neutron	0
Total (b + g + n)	.1

Identify anticipated radionuclides:
U-238 TH-234 U-234
PA-234 PA-234M

Airborne Radioactivity

Isotope	DAC
U-238	0.001

☒ Anticipated or ☐ Measured

Identify any contamination under paint or on inaccessible surfaces:

Not anticipated - possibly in target room

Completed by RCT / HPT	Name	Signature	ID Number	Date
☒ Completed	Thomas J. O'Dou		PM-1	1/09/1997

Radiological Work Permit AR-1

ALARA/RADIOLOGICAL PROTECTION REQUIREMENTS (to be completed by RCT)

Protective Clothing Requirements ☐ None ☒ Level I (Coveralls, 2 pair surgeon's gloves, and booties)
☐ Lab coat ☐ Skull cap ☐ Hood ☐ Level II (2 Coveralls, 2 pair surgeon's gloves, and 2 pair booties)
☒ Gloves ☒ Booties ☐ Tapes openings
☒ Other: Only required in contaminated areas

Respiratory Requirements ☒ None ☐ Respirator fit test card ☐ SCBA*
☐ Full-face respirator ☐ Ventilation ☐ Combination cartridge* ☐ Supplied air mask*
☐ Particulate cartridge ☐ Chemical cartridge* ☐ Supplied air suit*
☐ Job-specific air monitoring *Requires RSO or CHP approval
☒ Other: Unless indicated otherwise at job site.

Dosimetry Requirements ☐ None ☒ WB dosimeter ☐ Supplemental dosimeter
☐ TLD finger rings ☐ Special neutron dosimetry ☐ Pu access list ☐ Alarming dosimeter
☒ Special uninalysis ☐ Whole-body count ☐ Accident Dosimeter ☐ Nasal swipes
☐ Other:

Monitoring Requirements ☐ None ☐ Notify RCT before job starts @
☐ Intermittent coverage ☒ Personnel before leaving job ☐ Notify RCT at job end
☐ Continuous coverage ☐ RCT monitor doffing of anti-Cs ☒ Equipment and tools before removal
☒ Self-frisking ☒ Other: Only from contaminated areas.

Training Requirements ☐ RW I ☐ RW II ☒ Other: As required by GPI License & OSHA 40 hr

Additional ALARA Requirements ☒ None ☐ ALARA pre-job briefing
☐ ALARA review (see attachment)

Completed by RCT	Name	Signature	ID Number	Date
☒ Completed	Thomas J. O'Dou		PM-1	1/09/1997

HOLD POINTS / SPECIAL INSTRUCTIONS (to be completed by the RCT)

Hold Points or Special Instructions:

Protective clothing required in firing rooms (booties and gloves), in target room (tyveks, booties, gloves, taped), and when accessing HEPA filter bank internals (tyvek, booties, gloves, taped openings).

HEPA system to be bagged prior to opening. Floor outside HEPA banks to be covered with plastic prior to removal of HEPA filters. HEPA bank to be emptied for characterization. New HEPA filters may be installed at descretion of ARDEC (Fabiano), or HEPA system to be disabled with plastic seal and electrically disabled.

Areas of loose surface contamination above limits or near limits will be posted during the characterization.

Completed by RCT	Name	Signature	ID Number	Date
☒ Completed	Thomas J. O'Dou		PM-1	1/09/1997

Radiological Work Permit AR-1

APPROVALS

	Name	Signature	ID Number	Group	Date
1. Line Manager ☒ Approved	Thomas J. O'Dou		PM-1	VEGAS	1/09/1997
2. RCT Supervisor ☒ Approved	Dixie J. Wells		RSO-1	RSO	1/14/1997
3. Facility Manager ☒ Approved	Thomas J. O'Dou		PM-1	VEGAS	3/24/1997
4. Other ☐ Approved	Name	Signature	ID Number	Group	Date

POST-JOB RADIOLOGICAL CONDITIONS (to be completed by the RCT/HPT)

Measured Radiological Conditions *(Record all readings as highest / general area.)* ☐ See attached map

Surface Contamination (dpm/100 sq cm)

	Direct	Smear	LAS (large area swipe)
Alpha			
Beta/gamma			
Tritium			

External Dose Rate (mrem/hr in work area)

Beta + gamma	
Neutron	
Total (b + g + n)	

Airborne Radioactivity
DAC _____ ☐ Estimated or
Isotope _____ ☐ Measured

Survey of Personnel Leaving Job Site
☐ Personnel contaminated above applicable limits
(If yes, attach the Radiological Incident Report.)

Completed by RCT / HPT)	Name	Signature	Z Number	Date
☐ Completed				

REVIEW

Associated reports for this job *(indicate the ones that apply):*

☐ CAM results	☐ Nasal swipe data	☐ RWP acknowledgment log
☐ Job-specific air monitoring	☐ Urinalysis report	☐ Dose tracking report
☐ Pre-job survey data	☐ Whole-body count	☐ Radiological occurrence/incident report
☐ Post-job survey data	☐ Wound count	☐ Changes in ALARA/rad protection reqs
☐ Finger-ring data	☐ Skin contamination	☐ ALARA pre-job briefing
☐ Special dosimetry results	☐ Personal clothing survey	☐ Formal ALARA review
☐ Other:		

☐ Lessons learned (If Yes, then briefly explain. Add attachment if necessary.)

Reviewed by RCT	Name	Signature	ID Number	Date
☐ Reviewed				

Reviewed by RCT Supervisor	Name	Signature	ID Number	Date
☐ Reviewed				

Gutierrez - Palmenberg, Inc.

RWP Access Log

RWP No: AR-1 Revision No: 1 Date: 4/15/97

Work Location: ARDEC Picatinny Arsenal 6118 Start Date: 4/15/97 End Date:

Date	Name	SSN/IDN	Badge/TLD	PIC/SRD	Time In	Dose In	Time Out	Dose Out	T/Dose	Resp (✓)
4/15	T. O'Dou	016-44-6745	31039 0171068	NA	NA	NA	NA	NA		NO
	J. Maffessanti	161-40-8727	31039-006 0053714	↓	↓	↓	↓	↓		↓
	R. Grosjean	273-78-2957	31039 0037719							
	D. Davis	260-25-1007	31039-005 0062465							
	C. White	535-90-8444	31039-002 0021999							
	R. Ruprecht	022460602	31039 004-01311							
4/16	D. Lindsey									
	D. Ebersole									
4/24	D. Wells	425-90-8169	0069182	↓	↓	↓	↓	↓		↓

Form GPI6-2 - RWP Access Log - 2/97

Page 1 of 1

APPENDIX Q

SITE PHOTOGRAPHS BEFORE CHARACTERIZATION

ARDEC Picatinny Arsenal

Building 611 B Characterization

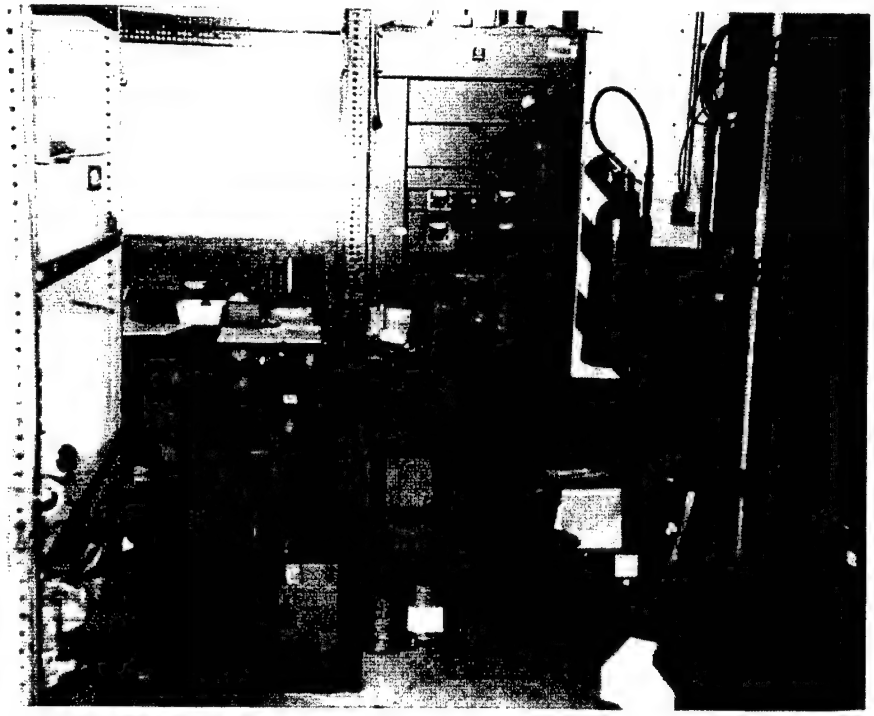
Site Photographs After Characterization

Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Las Vegas, NV 89106
702-647-5699

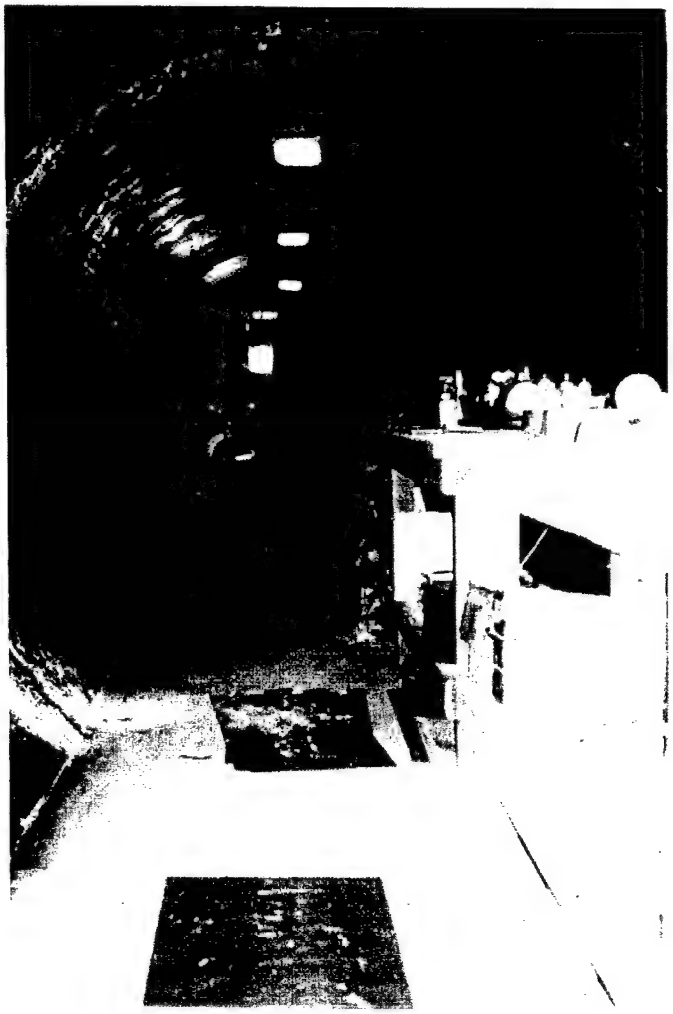
DU Target Room before characterization in foreground.

Open Storage Area before characterization.

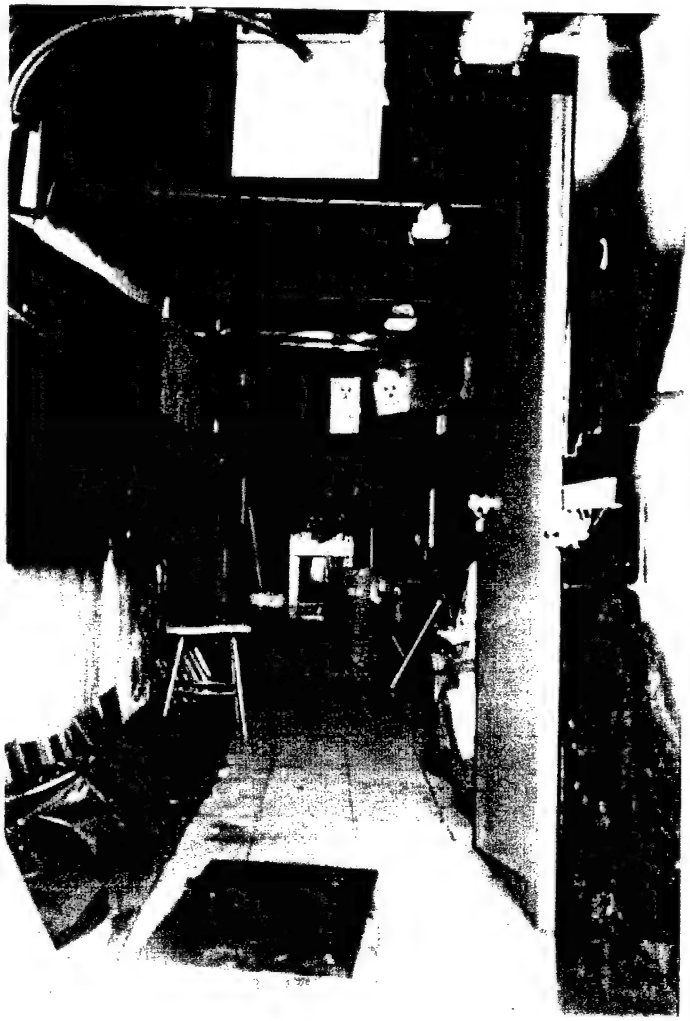
DU Tunnel from Target Room before characterization



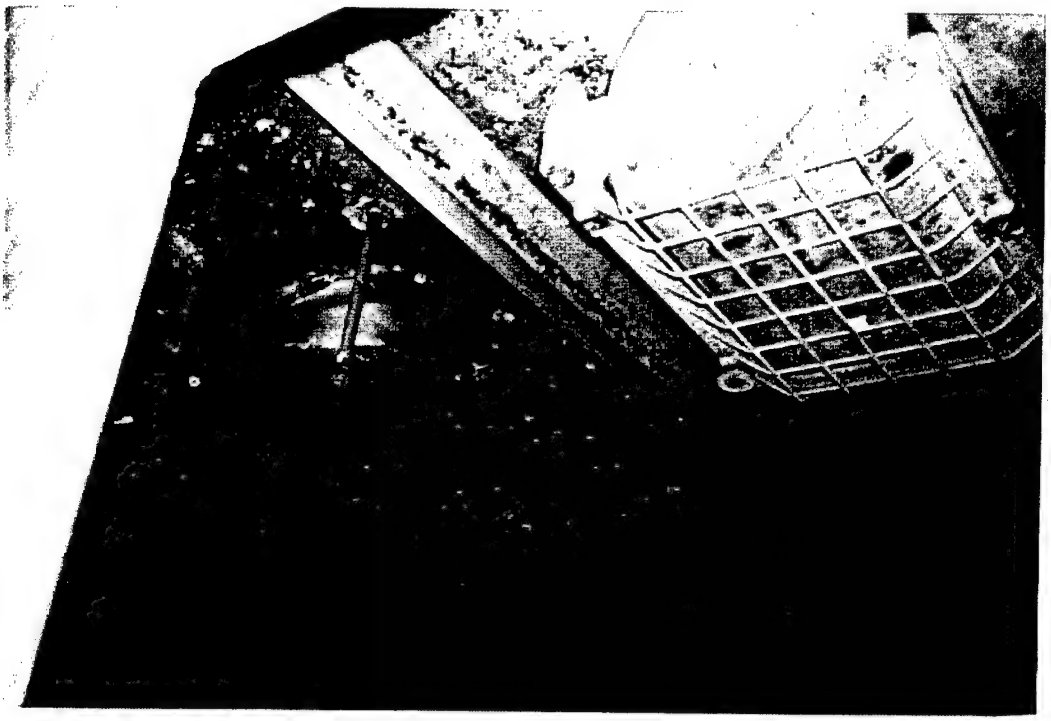
Instrument Room before characterization.



DU tunnel from entrance at the intersection with the non-DU tunnel before characterization.



Non-DU tunnel from entrance before characterization.



DU Target room ceiling with light fixture and duct to HEPA ventilation before characterization.

APPENDIX R

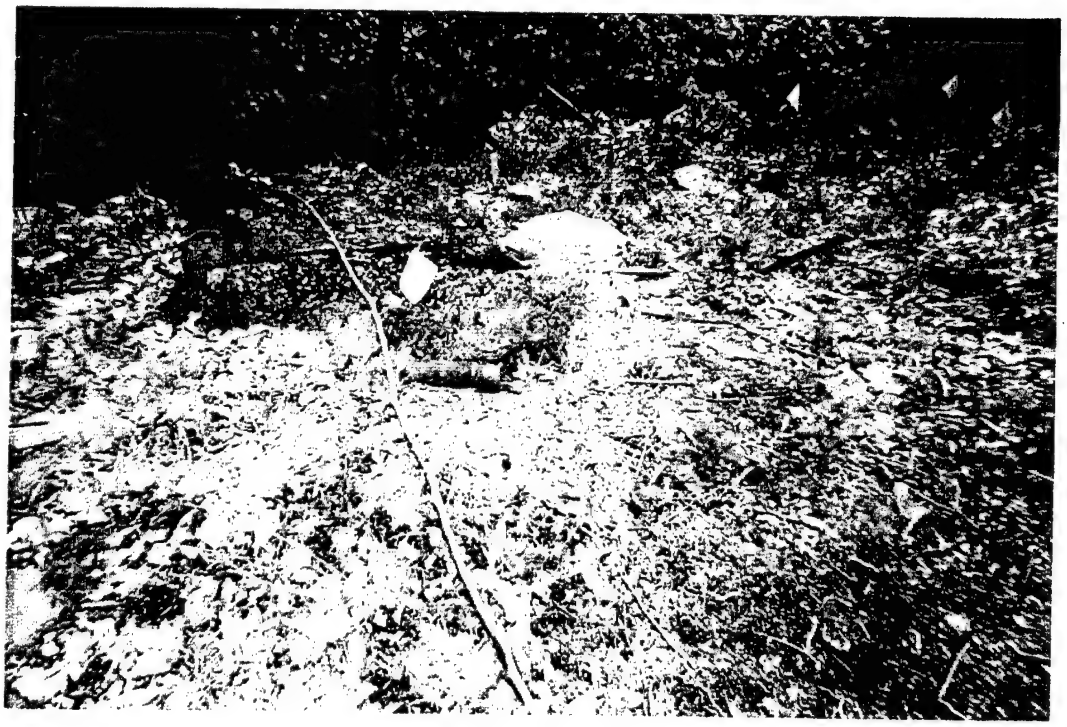
SITE PHOTOGRAPHS AFTER CHARACTERIZATION

ARDEC Picatinny Arsenal

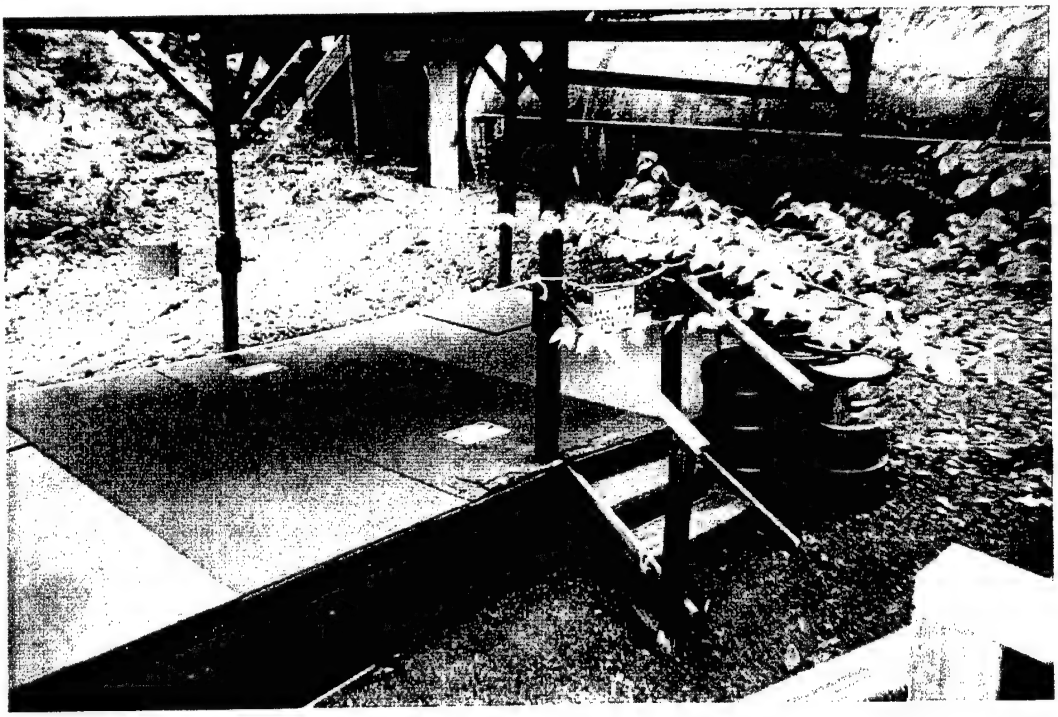
Building 611 B Characterization

Site Photographs Before Characterization

Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Las Vegas, NV 89106
702-647-5699

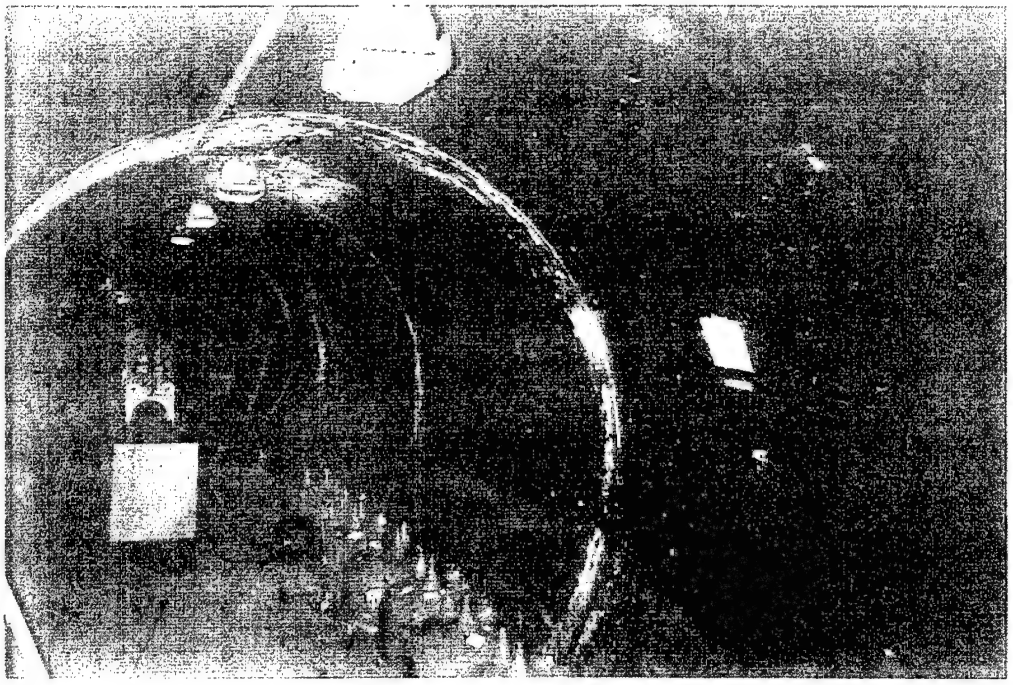


Unexploded ordinance locations adjacent to the brook at the side of the non-DU range.



The outside storage area after sealing the floor with latex paint.

The non-DU firing range from it's entry. The entry to the DU range is on the left side of th tunnel.



Inside the DU firing range facing the target room. Note the firing table on the left.

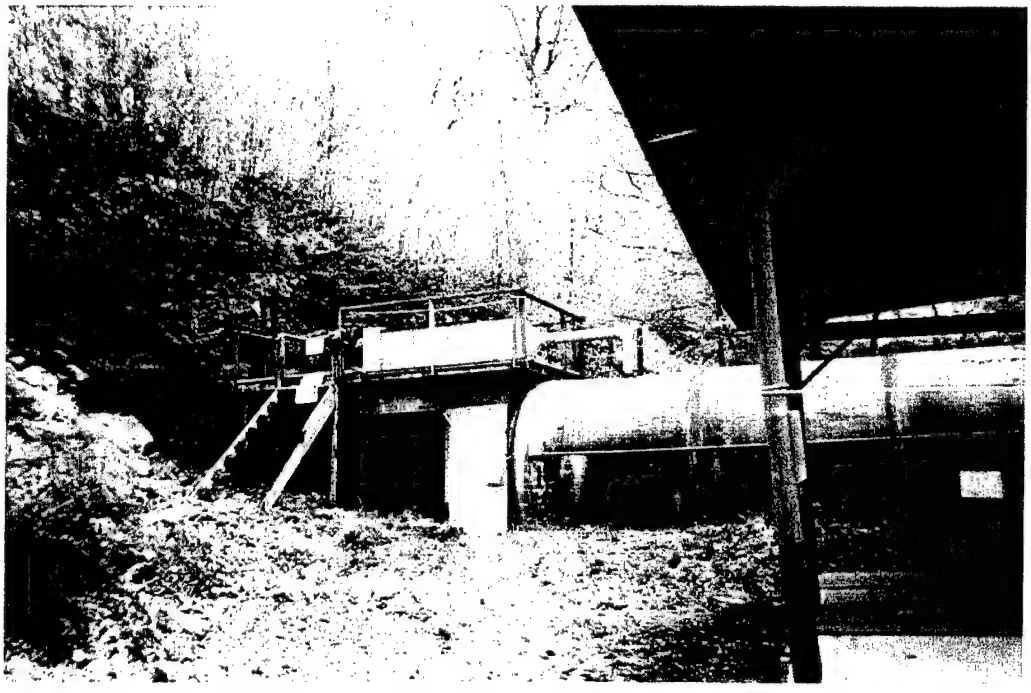
Inside the non-DU firing range facing the steel catch box.

The back yard showing the grounds and locations of unexploded ordinance. The large metal shield and the inside storage area.

The back yard area showing the place where a building existed behind the non-DU tunnel.

The "back yard" of the facility showing the connection of the DU and non-DU tunnels.

The backside of the non-DU tunnel showing the brook and marked unexploded ordinance.



The inside storage area and HEPA filter system and grounds.

The outside storage area with the DU tunnel in the background. The inside storage area and HEPA area at the left side.

Building 611B entrance showing the connection to the non-DU tunnel. The outside storage area after characterization is at the left.

Building 611B entrance showing the building foyer. The UST is at right center. The instrument room is at the back of the entry way.

APPENDIX S

SOIL SAMPLE RESULTS

ARDEC Picatinny Arsenal

Building 611B Characterization

Soil Sample Results

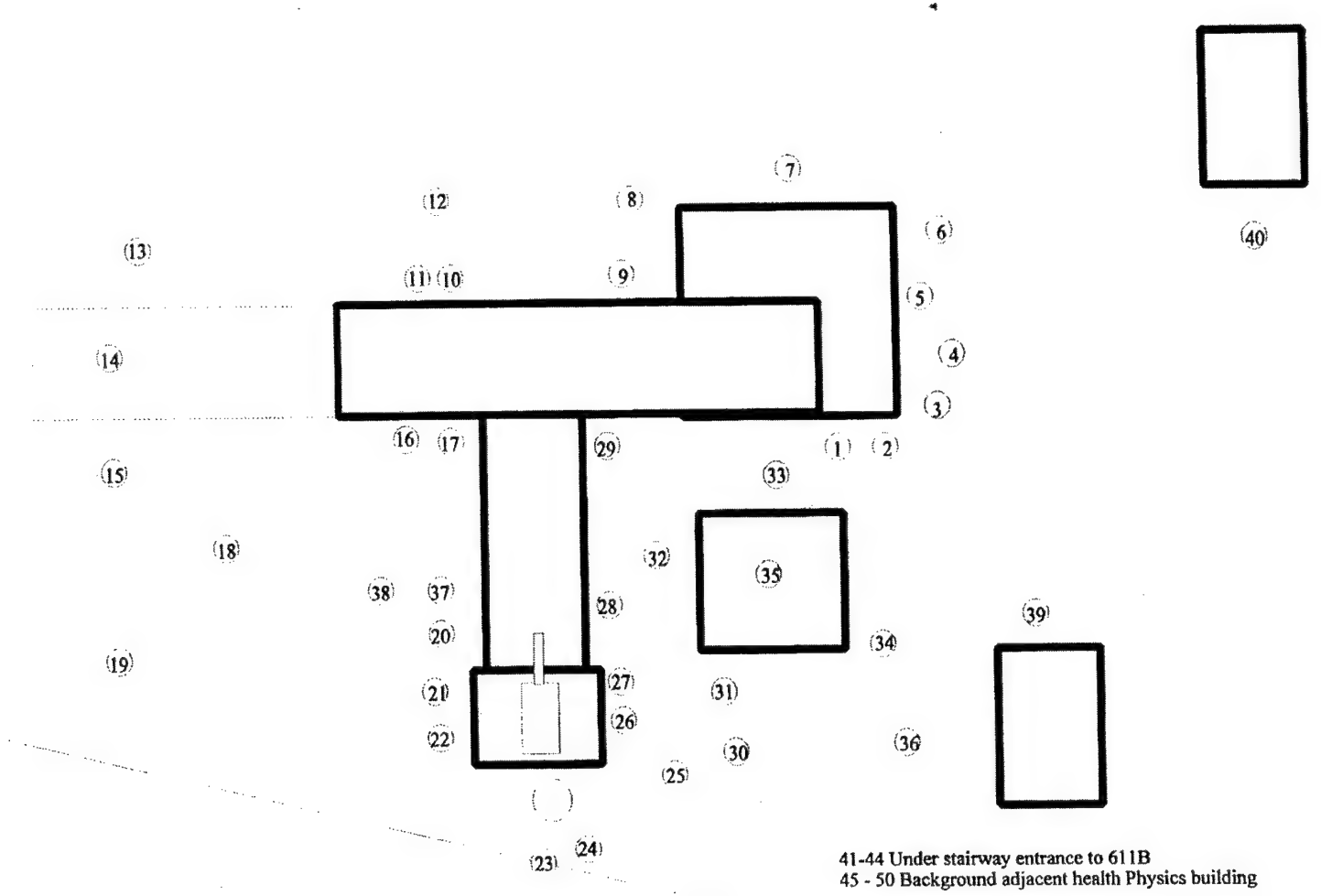
Notes

1. Sample results are reported as DU activity based on the activity concentration of ^{234}Th.

2. Sample results reported above the MDA value are reported as the activity (pCi/g) +/- the uncertainty (pCi/g) associated with the analysis.

3. Sample results reported below the MDA value are indicated as NDA with the MDA value in parentheses.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699



Fugure 3
Actual Soil Sample Locations
Gutierrez-Palmenberg, Inc.
ARDEC - Picatinny Arsenal
Building 611B Area

Sample ID Number	***ARDEC - Picatinny Arsenal Soil Sample Results*** Gutierrez-Palmenberg, Inc. - April 1997 Sample Locations - Building 611B	Activity Concentration (pCi/g) +/- (pCi/g) or NDA (MDA)
GPI-AR-1	At base of stairs leading to the foyer	5.26 +/- .63
GPI-AR-2	At base of stairs leading to the foyer	20.1 +/- 1.9
GPI-AR-3	Above the UST	8.85 +/- .84
GPI-AR-4	Above the UST	1.57 +/- .47
GPI-AR-5	Above the UST	2.21 +/- .52
GPI-AR-6	Aside the UST toward the brook	NDA (1.6)
GPI-AR-7	Back side of the instrument room	NDA (1.2)
GPI-AR-8	Back side of the non-DU tunnel	NDA (1.2)
GPI-AR-9	Back side of the non-DU tunnel	NDA (1.2)
GPI-AR-10	Outside window of non-DU Tunnel at back of structure	NDA (1.6)
GPI-AR-11	Outside window of non-DU Tunnel at back of structure	1.57 +/- .47
GPI-AR-12	Aside of brook adjacent to non-DU tunnel	NDA (1.7)
GPI-AR-13	Aside of open area at end of non-DU tunnel	NDA (3.3)
GPI-AR-14	In open area at end of non-DU tunnel	NDA (0.9)
GPI-AR-15	Aside of open area at end of DU tunnel in back yard	NDA (1.1)
GPI-AR-16	Outside window of non-DU tunnel in back yard	NDA (1.1)
GPI-AR-17	Outside window of non-DU tunnel in back yard	NDA (0.95)
GPI-AR-18	In back yard area	NDA (1.5)
GPI-AR-19	In back yard area	NDA (1.5)
GPI-AR-20	In back yard area adjacent DU target room	NDA (0.94)
GPI-AR-21	In back yard area adjacent inside storage room	2.9 +/- 1.1
GPI-AR-22	In back yard area adjacent inside storage room	10.9 +/- 2.0
GPI-AR-23	At the end of the DU range	NDA (5.5)
GPI-AR-24	At the end of the DU range	2.25 +/- 0.64
GPI-AR-25	At base of stairs from HEPA system platform	NDA (4.3)

Sample ID Number	***ARDEC - Picatinny Arsenal Soil Sample Results*** Gutierrez-Palmenberg, Inc. - April 1997 Location - Building 611B	Activity Concentration (pCi/g) +/- (pCi/g) or NDA (MDA)
GPI-AR-26	At the entrance to the inside storage area	69.8 +/- 5.1
GPI-AR-27	At the entrance to the inside storage area	12.5 +/- 1.1
GPI-AR-28	Adjacent to the DU firing room near open storage area	5.59 +/- 0.65
GPI-AR-29	Adjacent to the DU firing room near the non-DU range	3.1 +/- 0.59
GPI-AR-30	Adjacent to the open storage area near the covered metal	3.9 +/- 1.6
GPI-AR-31	Adjacent to the open storage area near open storage area	2.57 +/- 0.46
GPI-AR-32	Adjacent to the open storage area near DU storage area	1.09 +/- 0.37
GPI-AR-33	Adjacent to the open storage area near the entrance stairs	2.45 +/- 0.49
GPI-AR-34	Adjacent to the open storage area near the driveway	NDA (5.9)
GPI-AR-35	Under the center of the open storage area	NDA (0.96)
GPI-AR-36	Under metal pile adjacent to the storage box number 2	2.82 +/- 0.73
GPI-AR-37	Adjacent to the DU range in the back yard	NDA (1.1)
GPI-AR-38	Adjacent to the DU range in the back yard	NDA (1.5)
GPI-AR-39	At the entrance to the portable storage area #2	NDA (1.2)
GPI-AR-40	At the entrance to the portable storage area #2	NDA (1.2)
GPI-AR-41	Under stairway entrance to foyer in rain trough	78.9 +/- 6.3
GPI-AR-42	Under stairway entrance to foyer in rain trough	43.9 +/- 3.3
GPI-AR-43	Under stairway entrance to foyer in rain trough	106.7 +/- 7.8
GPI-AR-44	Under stairway entrance to foyer in rain trough	17.0 +/- 1.5
GPI-AR-45	Background sample adjacent to Health Physics Laboratory	NDA (1.4)
GPI-AR-46	Background sample adjacent to Health Physics Laboratory	NDA (1.4)
GPI-AR-47	Background sample adjacent to Health Physics Laboratory	NDA (1.8)
GPI-AR-48	Background sample adjacent to Health Physics Laboratory	NDA (1.1)
GPI-AR-49	Background sample adjacent to Health Physics Laboratory	3.2 +/- 1.5
GPI-AR-50	Background sample adjacent to Health Physics Laboratory	1.99 +/- 0.54

APPENDIX T

LABORATORY SPECIFICATION

ARDEC Picatinny Arsenal

Building 611B Characterization

Laboratory Specifications

Notes

1. This information describes the qualifications of LAS laboratories to analyze soil samples.

2. All soil samples are analyzed for depleted uranium by gamma spectroscopy in a New Jersey approved laboratory.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

Gutierrez - Palmenberg, Inc.

333 North Rancho Drive, Suite 580
Las Vegas, Nevada 89106

Mr. Gregory Zalaskus, NJDEP
DRPSR
Bureau of Federal Case Management
401 E. State St.
CN 128
Trenton, NJ 08625-0028

RE: NJ Approved Laboratory Analysis of Soil Samples

This letter serves to confirm our telecon of April 25, 1997. Our discussion was in regard to any change(s) that may have occurred in New Jersey Department of Environmental Protection (NJDEP) regulations since the issuance of the referenced letter. This letter specified NJDEP policy regarding laboratory certification for the analysis of Depleted Uranium (DU), Strontium 90 (^{90}Sr), and Radium 226 (^{226}Ra) in soils.

In specific questioning, you were informed that Gutierrez-Palmenberg, Inc (GPI) is presently characterizing Building 611B. This building is within the confines of the Picatinny Arsenal at or near Dover, NJ. Among the characterization methodologies, several types of samples will be taken - including soils which will be analyzed for the presence of DU.

You confirmed that no changes have occurred in NJDEP regulations with regard to soil analysis since your letter of October 1995 and that that letter remains as the NJDEP policy and/or position on soil analyses. In this matter, the letter states, *Analysis of these elements in soils will be considered as acceptable to the Department provided that the laboratory has participated and passed the Laboratory Intercomparisons for Soil program administered by the U.S. Department of Energy, Environmental Measurements Laboratory and/or the International Atomic Energy Association.*

GPI has contracted with LAS laboratory in Las Vegas, NV for analysis for DU. LAS has presented GPI with documentation that meets the NJDEP requirements. Therefore, for GPI's analysis of interest, LAS is qualified to analyze the soil samples taken at Picatinny Arsenal.

Thank you for your patience and cooperation in resolving this issue raised by Arsenal personnel. If you have any questions regarding these issues, feel free to contact; for GPI, myself or Thomas O'Dou at 702-647-5699, for LAS laboratory, Erin Hall-Meade at 800-582-7605, Mary Ford at 702-361-0220, for IOC, Mike Styveart at 309-782-0880, and for the Arsenal, Ted Gabel or Joe Fabiano at 201-724-3742.

Sincerely,

Dixie Wells, RSO
GPI-Las Vegas Operations

Reference: Letter from Gregory C Zalaskus to Ted Gabel, fax dated 10/6/95

cc: Robert Stern, Chief, BER
Erin Hall-Meade, Northern Pac Region, LAS
Dr. Charles Carter, Lab Director, LAS
Mary Ford, Project Manager, LAS
Thomas O'Dou, Program Manager, GPI
Walter C Cunningham, Vice President, GPI
Mike Styveart, Contracting POC, IOC
Ted Gabel, PM for Site Remed., ARDEC
Joe Fabiano, RW-POC, ARDEC
File

State of New Jersey

Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

Mr. Ted Gable
Project Manager for Site Restoration
U.S. Army Tank-Automotive and Armaments Command
Army Research, Development and Engineering Center
Picatinny Arsenal, New Jersey 07806-5000

OCT 06 1995

RE: Laboratory Certifications for
Radionuclide Contamination in Soils
Picatinny Arsenal, Morris County

Dear Mr. Gable:

This letter serves to confirm our 5 October, 1995 telephone conversation regarding the above referenced matter. The New Jersey Department of Environmental Protection (Department) has no laboratory quality certification procedures for analysis of Depleted Uranium, Strontium 90 and, Radium 226 in soils. Analysis of these elements in soils will be considered as acceptable to the Department provided that the laboratory has participated and passed the Laboratory Intercomparisons for Soil program administered by the U.S. Department of Energy, Environmental Measurements Laboratory and/or the International Atomic Energy Association.

If you have any questions regarding this matter, please call at 609-633-1455.

Sincerely,

Gregory C. Zalaskus, Case Manager
Bureau of Federal Case Management

c: Joe Marchesani, BGWPA
Jim Kealy, BEERA
Bill Roach, USEPA
Robert Stern, Chief, BER

State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.
Commissioner

Mr. Ted Gable
Project Manager for Site Restoration
U.S. Army Tank-Automotive and Armaments Command
Army Research, Development and Engineering Center
Picatinny Arsenal, New Jersey 07806-5000

OCT 06 1995

RE: Laboratory Certifications for
Radionuclide Contamination in Soils
Picatinny Arsenal, Morris County

Dear Mr. Gable:

This letter serves to confirm our 5 October, 1995 telephone conversation regarding the above referenced matter. The New Jersey Department of Environmental Protection (Department) has no laboratory quality certification procedures for analysis of Depleted Uranium, Strontium 90 and, Radium 226 in soils. Analysis of these elements in soils will be considered as acceptable to the Department provided that the laboratory has participated and passed the Laboratory Intercomparisons for Soil program administered by the U.S. Department of Energy, Environmental Measurements Laboratory and/or the International Atomic Energy Association.

If you have any questions regarding this matter, please call at 609-633-1455.

Sincerely,

Gregory C. Zalaskus, Case Manager
Bureau of Federal Case Management

c: Joe Marchesani, BGWPA
Jim Kealy, BEERA
Bill Roach, USEPA
Robert Stern, Chief, BER

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-SC-1

Page 1 of 6

ADMINISTRATIVE DATA

Project Number: USA 96-108

Project Name: ARDEC Characterization

Project Manager: Thomas J. O'Dou

Project Phone: ARDEC x 43685

Project Fax: _____

Reqd Report Date: ~~4/4/97~~ 5/13/97

Lab Contact: _____

Lab Phone: _____

Please send report to:

THOMAS J. O'DOU
333 N. RANCHO DRIVE
SUITE 580
LAS VEGAS, NV 89106

	Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-1	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
2	GPI-AR-2	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
3	GPI-AR-3	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
4	GPI-AR-4	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
5	GPI-AR-5	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
6	GPI-AR-6	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
7	GPI-AR-7	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
8	GPI-AR-8	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
9	GPI-AR-9	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
10	GPI-AR-10	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		

Initial Sample Custodian: THOMAS J. O'DOU

Notes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

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3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/16/97 Time: 1105

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-SC-1

Page 2 of 6

ADMINISTRATIVE DATA

Project Number: USA 96-108
Project Name: ARDEC Characterization
Project Manager: Thomas J. O'Dou
Project Phone: ARDEC x 43685

Project Fax: _____
Reqd Report Date: ~~4/29/97~~ 5/13/97
Lab Contact: _____
Lab Phone: _____

Please send report to:

Thomas J. O'Dou
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

	Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-11	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
2	GPI-AR-12	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
3	GPI-AR-13	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
4	GPI-AR-14	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
5	GPI-AR-15	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
6	GPI-AR-16	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
7	GPI-AR-17	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
8	GPI-AR-18	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
9	GPI-AR-19	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
10	GPI-AR-20	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		

Initial Sample Custodian: THOMAS J. O'DOU

Notes: INTERESTED IN DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

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2) Relinquished By: _____ Date: _____ Time: _____ — Received By: _____ Date: _____ Time: _____

3) Relinquished By: _____ Date: _____ Time: _____ — Received By: _____ Date: 5/6/97 Time: 1105

300

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Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-SC-1

Page 3 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108

Project Name ARDEC Characterization

Project Manager Thomas J. O'Dou

Project Phone ARDEC X43685

Project Fax _____

Reqd Report Date ~~4/29/97~~ 5/13/97

Lab Contact _____

Lab Phone _____

Please send report to:

Thomas J. O'Dou
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

	Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-21	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
2	GPI-AR-22	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
3	GPI-AR-23	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
4	GPI-AR-24	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
5	GPI-AR-25	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
6	GPI-AR-26	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
7	GPI-AR-27	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
8	GPI-AR-28	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
9	GPI-AR-29	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		
10	GPI-AR-30	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97		

Initial Sample Custodian: Thomas J. O'Dou

Notes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian Date: 4/31/97 Time: 1300 Received By: _____ Date: _____ Time: _____

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3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 1105

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Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. HEVEC-SC-1
Page 4 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108
Project Name ARDEC Characterization
Project Manager Thomas J. O'Dou
Project Phone ARDEC X43685

Project Fax _____
Reqd Report Date ~~4/24/97~~ 5/13/97
Lab Contact _____
Lab Phone _____

Please send report to:

THOMAS J. O'DOU
333 N. RANCHO DRIVE
SUITE 580
LAS VEGAS, NV 89106

	Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-31	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
2	GPI-AR-32	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
3	GPI-AR-33	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
4	GPI-AR-34	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
5	GPI-AR-35	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
6	GPI-AR-36	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
7	GPI-AR-37	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
8	GPI-AR-38	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
9	GPI-AR-39	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		
10	GPI-AR-40	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97		

Initial Sample Custodian: THOMAS J. O'DOU

Notes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian Date: 4/21/97 Time: 1300 Received By: _____ Date: _____ Time: _____

2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____

3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 1105

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-SC-1

Page 5 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108

Project Name ARDEC Characterization

Project Manager Thomas J. O'Dou

Project Phone ARDEC x 43685

Project Fax _____

Reqd Report Date ~~4/29/97~~ 5/13/97

Lab Contact _____

Lab Phone _____

Please send report to:

Thomas J. O'Dou
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

	Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-41	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
2	GPI-AR-42	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
3	GPI-AR-43	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
4	GPI-AR-44	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
5		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
6		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
7	N/A	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
8		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
9		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
10		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			

Initial Sample Custodian: Thomas J. O'Dou

Notes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian Date: 4/24/97 Time: 1300 Received By: _____ Date: _____ Time: _____

2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____

3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 1105

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-SC-1

Page 6 of 6

ADMINISTRATIVE DATA

Project Number: USA 96-108
Project Name: ARDEC Characterization
Project Manager: Thomas J. O'Dou
Project Phone: ARDEC x43685

Project Fax: _____
Reqd Report Date: 5/13/97
Lab Contact: _____
Lab Phone: _____

Please send report to:

	Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-45	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/29/97		
2	GPI-AR-46	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/29/97		
3	GPI-AR-47	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/29/97		
4	GPI-AR-48	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/29/97		
5	GPI-AR-49	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/29/97		
6	GPI-AR-50	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/29/97		
7		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
8	NA	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
9		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
10		Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			

Initial Sample Custodian: Thomas J. O'Dou

Notes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian — Date: 4/31/97 Time: 1300 — Received By: _____ Date: _____ Time: _____

2) Relinquished By: _____ Date: _____ Time: _____ — Received By: _____ Date: _____ Time: _____

3) Relinquished By: _____ Date: _____ Time: _____ — Received By: _____ Date: 5/6/97 Time: 1105

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AMSTA-AR-CO, LTC Crone, Jr.
AMSTA-AR-PSS, O. Perry
Picatinny, NJ 07806-5000

Defense Technical Information Center (DTIC)
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Aberdeen Proving Ground, MD 21010-5423

Director
U.S. Army Research Laboratory
ATTN: AMSRL-CI-LP, Technical Library
Bldg. 4600
Aberdeen Proving Ground, MD 21005-5066

Chief
Benet Weapons Laboratory, CCAC
U.S. Army Research, Development and Engineering Command
Armament Research, Development and Engineering Center
ATTN: AMSTA-AR-CCB-TL
Watervliet, NY 12189-5000

Director
U.S. Army TRADOC Analysis Center-WSMR
ATTN: ATRC-WSS-R
White Sands Missile Range, NM 88002

Commander
Naval Air Warfare Center Weapons Division
1 Administration Circle
ATTN: Code 473C1D (2)
China Lake, CA 93555-6001

Chemical Propulsion Information Agency
ATTN: Accessions
10630 Little Patuxent Parkway, Suite 202
Columbia, MD 21044-3204

GIDEP Operations Center
P.O. Box 8000
Corona, CA 91718-8000

U.S. Army Tank-automotive and Armaments Command
ATTN: AMSTA-CS-CZR, M. Styvaert (3)
Rock Island, IL 61299-7630

USACE, Baltimore District
ATTN: CENAB-EN-HI, H. Honerlah
C. Hallam
10 South Howard St.
Baltimore, MD 21201

Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
U.S. Nuclear Regulatory Commission
ATTN: Ms Betsy Ulrich
Region I
475 Allendale Road
King of Prussia, PA 19406-1415